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MINERAL INVESTIGATION OF THE OH-BE-JOYFUL WILDERNESS STUDY AREA, GUNNISON COUNTY, COLORADO

By
Clarence E. Ellis

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This open file report summarizes the results of a Bureau of Mines wilderness study and will be incorporated in a joint report with the U.S. Geological Survey. The report is preliminary and has not been edited or reviewed for conformity with the U.S. Bureau of Mines editorial standards. Work on this study was conducted by personnel from Intermountain Field Operations Center, Building 20, Denver Federal Center, Denver, CO 80225.

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FOREWORD

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and the Joint Conference Report on Senate Bill 4, 88th Congress, the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report discusses the results of a mineral survey of the Oh-Be-Joyful Wilderness Study Area, Gunnison National Forest, Gunnison County, Colorado. The area was established as a wilderness study area by Public Law 96-560, December 22, 1980.

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MINERAL INVESTIGATION OF THE OH-BE-JOYFUL WILDERNESS STUDY AREA, GUNNISON COUNTY, COLORADO

Clarence E. Ellis, Bureau of Mines

INTRODUCTION

The Bureau of Mines, as part of a joint effort with the Geological Survey, conducted a mineral investigation of the Oh-Be-Joyful Wilderness Study Area in 1976 and 1981.

Location, size, and geographic setting

The Oh-Be-Joyful Wilderness Study Area is about 4 mi northwest of Crested Butte, Colo., and about 25 mi north-northwest of Gunnison in southwestern Colorado (fig. 1). The study area covers about 5,500 acres of the Gunnison National Forest in Gunnison County.

The Oh-Be-Joyful study area is reached from Crested Butte either by the Slate River road on the east or by the Kebler Pass road on the south. From the Slate River road, jeep trails approach the study area by ascending Baxter Basin on the north side of the study area, or by ascending Oh-Be-Joyful Creek into the study area. From the Kebler Pass road, the Keystone and Micawber (Standard) Mines roads approach the area's southern boundary; a jeep trail above Lake Irwin Campground forms another route to the Oh-Be-Joyful area and is reached by a maintained road from Kebler Pass.

The crest of the Ruby Range forms the western boundary of the study area and is the eastern boundary of the Raggeds Wilderness. The study area is the upper drainage of Oh-Be-Joyful Creek and its tributaries, which originate in Peeler and Democrat Basins. Five peaks, ranging from 12,400 ft to 12,800 ft, form the crest of the Ruby Range along the area's western boundary. Schuylkill Mountain (elevation 12,146 ft) dominates the long ridge forming the northern

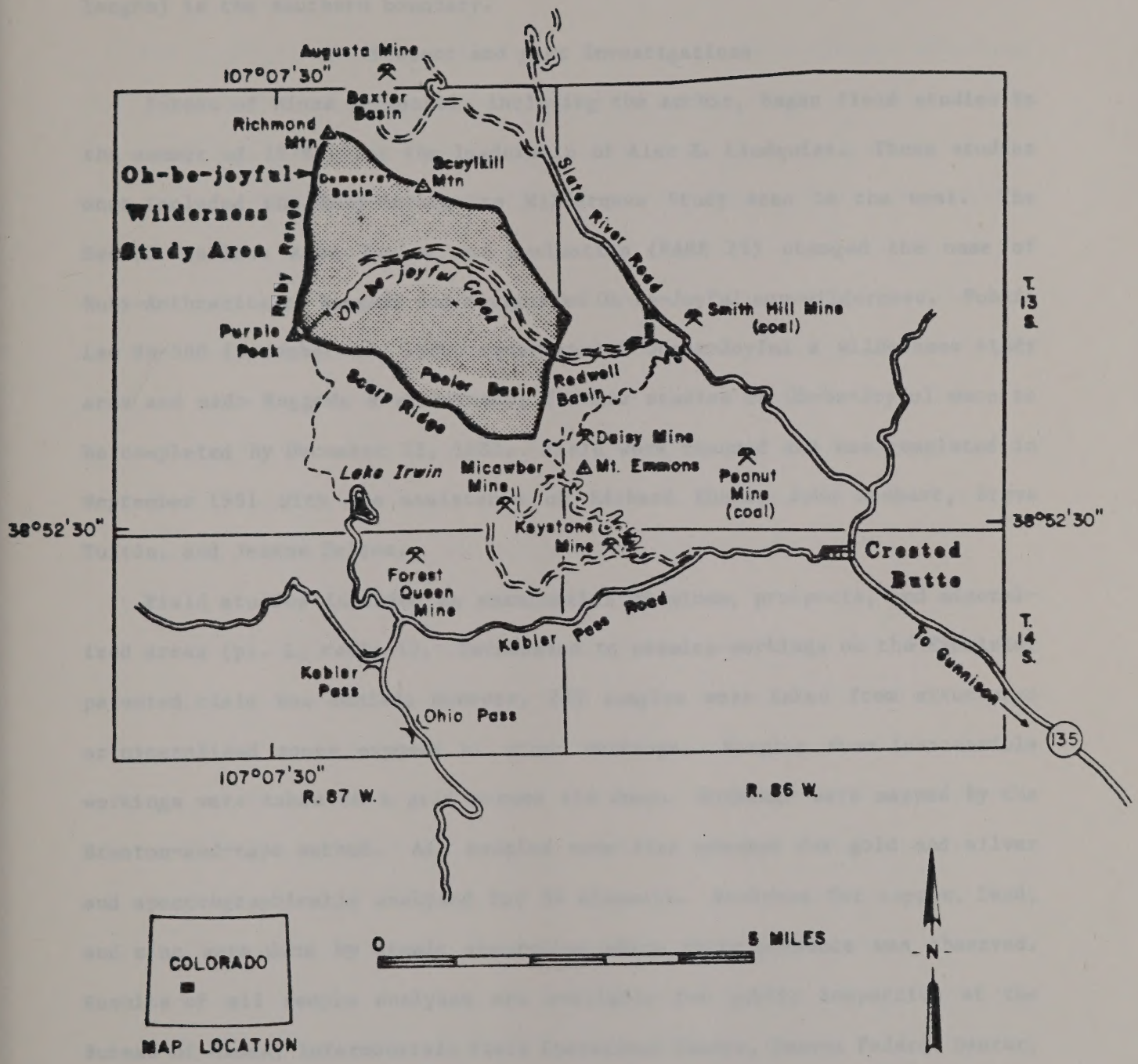

Figure 1.--Index map of the Oh-Be-Joyful Wilderness Study Area, Gunnison County, Colorado.

boundary. Scarp Ridge (averaging more than 12,000 ft elevation along its full length) is the southern boundary.

Present and past investigations

Bureau of Mines personnel, including the author, began field studies in the summer of 1976 under the leadership of Alec E. Lindquist. These studies once included the Ruby-Anthracite Wilderness Study Area to the west. The Second Roadless Area Review and Evaluation (RARE II) changed the name of Ruby-Anthracite to Raggeds and designated Oh-Be-Joyful non-wilderness. Public Law 96-560 (December 22, 1980) redesignated Oh-Be-Joyful a wilderness study area and made Raggeds a wilderness; further studies on Oh-Be-Joyful were to be completed by December 22, 1983. Field work resumed and was completed in September 1981 with the assistance of Richard Kness, John Neubert, Steve Tuftin, and Jeanne Zelten.

Field studies included an examination of mines, prospects, and mineralized areas (pl. 1, table 1). Permission to examine workings on the Excelsior patented claim was denied; however, 269 samples were taken from structures or mineralized zones exposed at other workings. Samples from inaccessible workings were taken on a grid across the dump. Workings were mapped by the Brunton-and-tape method. All samples were fire assayed for gold and silver and spectrographically analyzed for 34 elements. Analyses for copper, lead, and zinc were done by atomic absorption where their presence was observed. Results of all sample analyses are available for public inspection at the Bureau of Mines, Intermountain Field Operations Center, Denver Federal Center, Denver, Colo. 80225.

Preliminary studies included a search of claim records in the Gunnison County Courthouse, a search of claim records and mineral leases at the Colorado State office of the U.S. Bureau of Land Management, a search of published

literature, and a search of files of the U.S. Bureau of Mines and the Colorado Division of Mines.

The principal published references were on the Irwin district (Socolow, 1955), the Redwell Basin molybdenum deposit (Sharp, 1978), the Mount Emmons molybdenum deposit (Thomas and Galey, 1982), and the geologic map of the Oh-Be-Joyful 7-1/2-minute quadrangle (Gaskill and others, 1967). Unpublished references were Defense Minerals Exploration Administration reports on the Keystone, Micawber, and Daisy Mines, and private reports on the Keystone, Micawber, Daisy, Augusta, and Ruby No. 1 Mines. Willis White (Climax Molybdenum Co.), John Hahn (owner of the Forest Queen Mine), and E. Perussic (U.S. Energy Co.) provided much valuable information. Much of the information from these unpublished sources is confidential, but only that information which may be relevent and is not confidential is presented herein.

Mining activity

The Oh-Be-Joyful study area adjoins the northern edge of the Crested Butte coal mining district and is entirely within the Ruby mining district. A subdistrict of the Ruby, the Irwin silver district, is centered about 1 mi southwest of the study area. Mining in the region began in 1874 in the Irwin district when the district was still part of the Ute Indian Reservation. The Ruby Chief and Bullion King Mines, followed by the Forest Queen and Ruby King Mines were the district's early principal producers. In 1882, a snowslide shut down the Ruby Chief and another slide in 1884 wiped out the Bullion King, which never reopened. By 1890, the silver-mining era of the Irwin district ended; low silver prices, snowslides, water flooding at depth, and, in some mines, ore depletion were the causes. The Forest Queen continued to operate sporadically, reaching $1 million in production by 1915 (Socolow, 1955, p. 52-53). Other production figures for the early period are unavailable or incomplete.

In the Ruby district just north of the Oh-Be-Joyful Wilderness Study Area, the Augusta Mine and smaller properties in Baxter Basin (fig. 1) operated from 1883 to the 1910's before losing the battle with snow. During the early 1900's attempts were made to work the silver-rich base-metal veins of the region, but little was accomplished until 1950 when the Keystone, Micawber (Standard), Daisy Mines began operations near the southeast corner of the study area (fig. 1). These base-metal veins were mined until 1969, after which molybdenum exploration became the main activity. Two deposits, one in Redwell Basin and the other in Red Lady Basin, were discovered. The Red Lady Basin deposit--AMAX's Mount Emmons deposit--has been delineated, and a mine was planned to come on stream in the mid-1980's. The Redwell Basin deposit has not been fully delineated by drilling (W. White, Climax Molybdenum Co., oral communication, 1981).

Within the Oh-Be-Joyful study area, silver production was small from Democrat Basin in the 1930's; silver production also was small from Peeler Basin during an unknown period.

Coal was mined from the northern part of the Crested Butte district--from the Smith (Anthracite Mesa) Mine about 1-1/2 mi east of the study area, south to Crested Butte--from 1884 to 1954.

The Oh-Be-Joyful study area had five patented mining claims and about 4,800 acres of unpatented claims as of March 1982 (fig. 2). Oil and gas leases covered about 4,700 acres as of January 1979 (fig. 3). No drilling for oil and gas had been conducted as of September 1981.

MINING DISTRICTS AND MINERALIZED AREAS

Crested Butte coal mining district

Within 2 to 4 mi of the study area, the Smith Hill (Anthracite Mesa) and Silver Brook (Peanut) Mines, as well as three mines not shown on plate 1

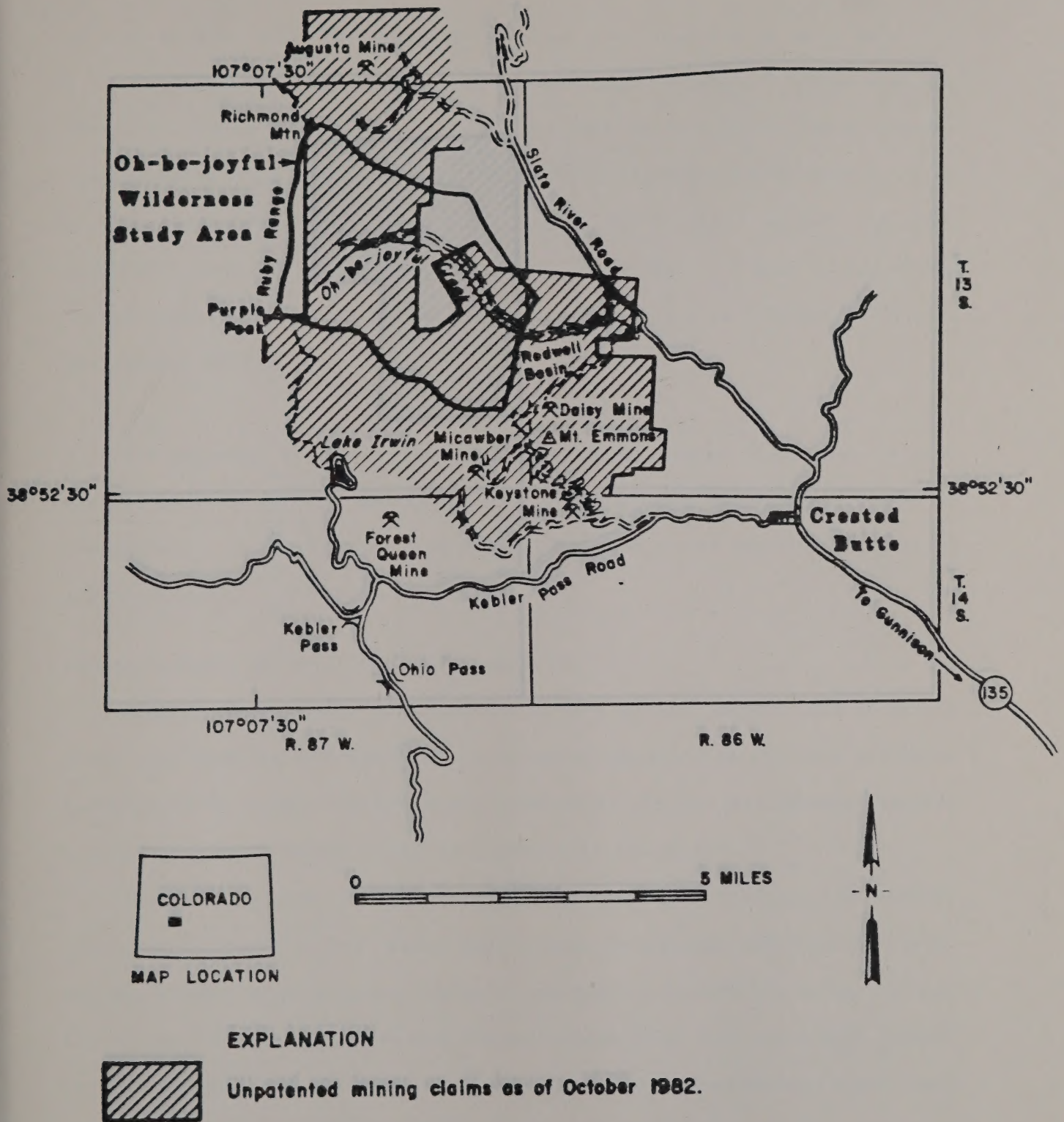

Figure 2.--Map of the Oh-Be-Joyful Wilderness Study Area showing unpatented mining claims on file with the BLM as of October 1982 (where pattern is open the claim blocks extend farther in that direction).

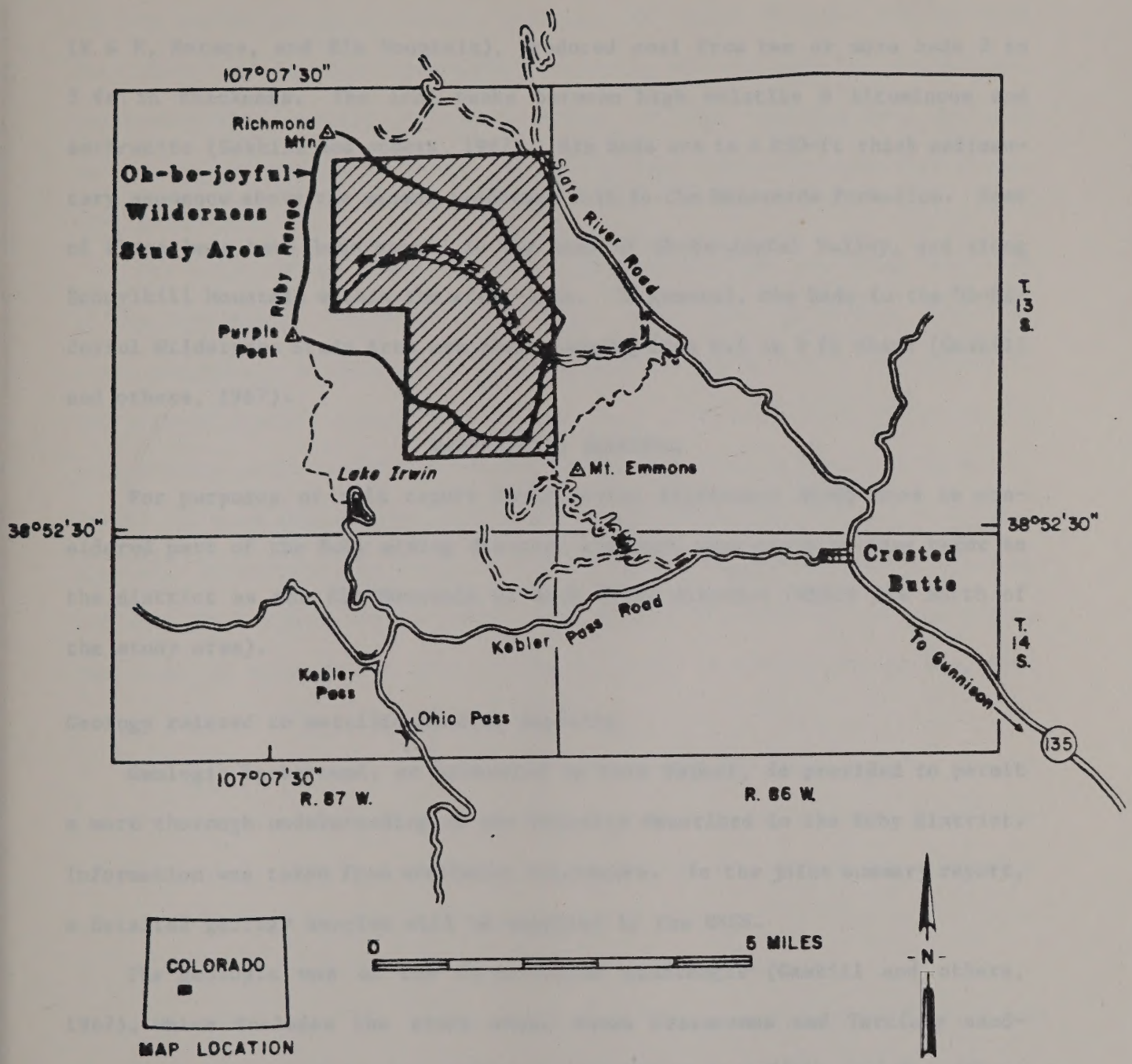

Figure 3.--Map showing oil and gas leases in and near the Oh-Be-Joyful Wilderness Study Area as of January 1979.

(K & K, Horace, and Elk Mountain), produced coal from two or more beds 2 to 5 ft in thickness. The coal ranks between high volatile B bituminous and anthracite (Gaskill and others, 1967). Six beds are in a 250-ft thick sedimentary sequence above the second sandstone unit in the Mesaverde Formation. Some of these beds have been mapped in the head of Oh-Be-Joyful Valley, and along Schuylkill Mountain within the study area. In general, the beds in the Oh-Be-Joyful Wilderness Study Area are thin, ranging from 0.5 to 3 ft thick (Gaskill and others, 1967).

Ruby mining district

For purposes of this report Oh-Be-Joyful Wilderness Study Area is considered part of the Ruby mining district although some claim notices refer to the district as the Elk Mountain or Rock Creek district (which are north of the study area).

Geology related to metallic mineral deposits

Geologic background, as presented in this report, is provided to permit a more thorough understanding of the deposits described in the Ruby district. Information was taken from available literature. In the joint summary report, a detailed geology section will be supplied by the USGS.

The geologic map of the Oh-Be-Joyful quadrangle (Gaskill and others, 1967), which includes the study area, shows Cretaceous and Tertiary sandstones, shales, conglomerates, and coal intruded by laccoliths, stocks, dikes, sills, and a felsite plug. Within the wilderness study area the oldest exposed rocks are the upper unit of the Mancos Shale. Few productive veins have been found in the Mancos which is the least competent formation in the area. The overlying Mesaverde Formation, a somewhat more competent unit consisting of interbedded sandstone, shale, and coal contains the Keystone and Daisy veins

and the smaller veins in Baxter, Democrat, and Peeler Basins. The Tertiary Ohio Creek[1] and Wasatch Formations, consisting of conglomerates, sandstones, and shales also contain productive veins. No mine workings have followed veins into the underlying Mancos, therefore vein continuity into that formation is unknown.

The acidic Afley, Augusta, and Mt. Owen stocks crop out along the crest of the Ruby Range. Veins in these stocks, except for the Augusta vein, are small and weakly mineralized. Dikes related to these stocks are plentiful and contain similar weakly mineralized veins. No veins were found in the granodiorite porphyry sills in Peeler Basin nor in the valley of Oh-Be-Joyful Creek. To some degree, most of the stocks and dikes have been hydrothermally altered. Molybdenite was found in a drill hole in the saddle between Mt. Owen and Ruby Peak (just off the west edge of pl. 1), but not in sufficient quantities to spur further exploration (W. White, Climax Molybdenum Co., oral communication, 1981).

The felsite plug in Redwell Basin is the youngest exposed rock. It and younger granitic rocks discovered during drilling are host to molybdenum mineralization. Similar buried granitic rocks are the host to the molybdenum mineralization of the Mount Emmons deposit.

Sequence of events related to mineral deposits

Irwin district (Socolow, 1955)	Redwell Basin (Sharp, 1978)	Oh-Be-Joyful study area (this study)
1. Intrusion of stocks and laccoliths, development of fracture system.	Same as Irwin district.	Same as Irwin district; shallow emplacement depth.

[1]The Ohio Creek Formation was described as the upper member of the Mesaverde Formation by Johnson and May (1980). The older usage is retained in this report.

Sequence of events related to mineral deposits--Continued

Irwin district (Socolow, 1955)	Redwell Basin (Sharp, 1978)	Oh-Be-Joyful study area (Ellis, 1983)
2. Open fractures are quartz filled.	Rhyolite porphyry intruded sediments, followed by the first stage of molybdenum mineralization.	Open fractures are quartz filled; minor amounts of silver and pyrite.
3. Quartz veins and wall rocks are brecciated.	Second phase of intrusion; felsite; breccia pipe formed.	Minor faults, veins are brecciated and quartz and pyrite are deposited.
4. Silver mineralization and quartz, pyrite, and arsenopyrite.	Base-metal and silver mineralization.	Argentiferous base-metal veins formed.
5. Brecciation.	Intrusion of porphyritic granite, brecciation, second stage of molybdenum mineralization.	Minor faults and brecciation; molybdenum, gold, and silver.
6. Quartz and calcite.	Barren fluids, brecciation.	Northwest-trending calcite veins containing silver.

Sharp (1978, p. 371) believed that existing fractures localized the multi-stage Redwell Basin intrusive and that these fractures were mineralized by fluids emanating from this intrusive. Thomas and Galey (1982, p. 1094) believed the intrusive preceded and caused the fracturing. The Mount Emmons intrusive is chemically and lithologically similar to the Redwell Basin intrusive, and separated by less than 1/2 mi, suggesting that both intrusives are cupolas of the same parent magma; this relationship of the intrusives has not yet been proven (W. White, oral communication, 1981).

The entire study area is in a molybdenum province. In addition to the Redwell Basin and Mount Emmons deposits, molybdenum has been found in workings in upper Yule Creek and on Augusta Mountain to the north, in drill holes in Paradise Basin to the northeast, in the saddle between Mt. Owen and Ruby Peak,

and near Lake Irwin (both the saddle and the lake are southwest of the study area). The base-metal mineralization is more obvious than the molybdenum mineralization and far better exposed in mine workings and on the surface.

Although almost the entire study area is mineralized, it is here divided into centers of mineralization referred to as: Mount Emmons-Keystone, Redwell Basin-Micawber, Independence, Scarp, Richmond Mountain, Augusta, and Oh-Be-Joyful headwaters. Mount Emmons-Keystone and Redwell Basin-Micawber are centers of mineralization each consisting of a molybdenum deposit and a related base-metal and silver vein or veins. Both centers are less than 1 mi southeast of the wilderness study area (pl. 1). The molybdenum deposits have been explored by core drilling. The other centers have been explored by prospect and mine workings. The Mount Emmons-Keystone and Redwell Basin-Micawber are herein presented as a model of centers of mineralization in this area.

Mount Emmons-Keystone

In 1978, AMAX announced the discovery of the Mount Emmons deposit, which contains 165 million tons of 0.43 percent MoS_2 beneath Red Lady Basin. The deposit is about 3/4 mi southeast of the study area. Granitic intrusive rocks are the main host for the mineralization, but the ore body extends into the surrounding sedimentary rocks.

The Keystone Mine, farther southeast, produced silver, gold, and base metals from two parallel, northwest-trending veins that intersect the Mount Emmons deposit (table 1). The base-metal veins cut the earlier of two known stages of molybdenite veinlets. The base-metal veins are composed of black-jack sphalerite, pyrite, galena, chalcopyrite, banded and vuggy quartz, rhodochrosite, and rhodonite. The veins generally fill open spaces along a normal fault that shows small left-lateral displacement. The left-lateral

movement caused the veins to pinch where they trend north-northwest and to swell where they trend northwest.

Because of extensive work on the part of others, Bureau of Mines personnel made only a reconnaissance of the Mount Emmons-Keystone center of mineralization.

Redwell Basin-Micawber

Exploration of the Redwell Basin molybdenum deposit, less than 1/2 mi southeast of the study area, has been conducted from 1968 to the present (1982). Sharp (1978) recognized two stages of molybdenum mineralization in a multi-stage granitic intrusion. Thomas and Galey (1982) identified two stages of granitic intrusion and a separate mineralized body for each.

The Micawber Mine, southwest of Redwell Basin (fig. 4A; table 1), produced silver, gold, and base metals from a vein that intersects the Redwell Basin deposit, although the mine workings do not intersect the molybdenum mineralization. The Micawber vein is similar to the Keystone vein except that the Micawber strikes northeast and the major swell on the vein was caused by a few hundred feet of right-lateral movement. Projecting the Micawber vein southwest indicates it could be on the same fault as the vein at the Forest Queen Mine (fig. 1). The Forest Queen vein contains native and ruby silver in quartz and arsenopyrite gangue. Both galena and sphalerite are present, but only in small quantities (Socolow, 1955, p. 62). If the correlation of the Micawber and Forest Queen veins is valid, the veins are clearly zoned away from the intrusive source.

The Daisy Mine (pl. 1), just southeast of the Redwell Basin deposit, worked an arcuate vein containing the same minerals as the Keystone and Micawber. The Daisy vein is traceable about 1,000 ft along strike and dips into

the Redwell intrusive. Sharp (1978) interpreted the Daisy vein as a shovel (listric) fault resulting from the early intrusive stage, and the base-metal mineralization occurring between stages of molybdenum mineralization. An extension of the Daisy vein was discovered during exploration drilling in the Redwell Basin deposit. The vein has a true thickness of 41 ft where it was intersected (W. White, Climax Molybdenum Co., oral communication, 1981).

The Redwell Basin-Micawber center of mineralization also has been well studied; therefore, the Bureau of Mines work was limited to reconnaissance.

Model of a center of mineralization

The Mount Emmons-Keystone and Redwell Basin-Micawber centers of mineralization are similar, allowing the formulation of a model for this local area: a multiple-stage molybdenum-bearing intrusion created faults of small displacement that received silver and base-metal mineralization during one or more stages of the intrusion. Close to the intrusion, the vein materials consist of blackjack sphalerite, pyrite, galena, quartz, calcite, minor chalcopyrite, and, possibly, tetrahedrite. Both the galena and sphalerite contain considerable amounts of silver. Far from the intrusion, the vein is primarily quartz, with sparse sulfides (mostly pyrite), native and ruby silver, and arsenopyrite. The proximity of the Mount Emmons-Keystone and Redwell Basin-Micawber centers of mineralization to the Oh-Be-Joyful Wilderness Study Area allows a high degree of confidence for extending the model to the poorly explored occurrences within, or extending into, the study area. Descriptions of these occurrences (Independence vein, Scarp vein, Richmond Mountain veins, Augusta vein, and Oh-Be-Joyful headwaters), which appear to be evidence of similar centers of mineralization, follow.

Independence vein

Extending from Independence Basin south of the study area to Peeler Basin within the study area (fig. 4A), the Independence vein has been prospected and mined intermittently since about 1890. Where mined in the southwest side of Independence Basin, the vein is primarily quartz with sparse sulfides (including pyrite), and fair silver content (fig. 4A; table 2). Drill-hole intercepts in the upper basin are similar (E. Perussic, U.S. Energy Co., oral communication, 1976). Workings on the vein in Peeler Basin, within the study area, show blackjack sphalerite, pyrite, and galena in quartz and calcite gangue (fig. 4B). Silver is present in good quantity. Prospects on the vein at Peeler Falls (fig. 4C) expose pyrite cubes in gouge but little visible sphalerite and galena; samples assay high in silver, lead, and zinc. The gouge is obviously metal-rich. The fault which the vein follows has had both dip-slip and strike-slip movement. The northwest side is upthrown, and the strike-slip movement is right lateral. Pinching and swelling are well displayed at Peeler Falls. Mineral zoning in the vein is indicated.

From Peeler Falls, the fault projects northeastward to the bottom of the valley of Oh-Be-Joyful Creek at the eastern edge of the study area, where the rocks are brecciated, extensively altered, and cut by quartz veinlets. AMAX drilled two holes into this altered area just outside of the eastern boundary of the study area and found rock that is mineralogically and chemically similar to rocks of the Mount Emmons deposit, and molybdenite is present (W. White, Climax Molybdenum Co., oral communication, 1981). The likelihood is good of there being a center of molybdenum mineralization related to the Independence vein below the eastern boundary of the Oh-Be-Joyful study area.

A small identified silver and base-metal resource exists in the Independence vein at the workings in Peeler Basin within the study area.

Scarp vein

South of Scarp Ridge, in what was once known as Justice Basin (fig. 5A), workings on the Scarp vein, despite intense prospecting, exposed only a narrow quartz vein (or veins) with minor pyrite and silver (table 3). To the west and at a lower elevation in Robinson Basin, plentiful sulfides--blackjack sphalerite, pyrite, and galena--are on dumps of caved workings by the creek draining the basin. The geologic map of Gaskill and others, 1967, shows the Scarp fault terminating just north of Scarp Ridge in Peeler Basin. Projecting the fault farther east-northeast, assuming minimal offset, would intersect it with the altered area drilled by AMAX in the valley of Oh-Be-Joyful Creek. The weak mineralization in Justice Basin may be due to pinching of the vein in this area. Conversely, the minerals found in Justice Basin and Robinson Basin could indicate zoning away from a center of mineralization to the west of Robinson Basin where molybdenum was found at the Ruby Peak-Mt. Owen saddle.

Although the Scarp vein could be considered a component of the center of mineralization that is under Oh-Be-Joyful Creek, no resources related to the Scarp vein can be identified within the study area.

Richmond Mountain veins

Under Richmond Mountain on the northwest corner of the study area lies a probable source for five, possibly intersecting, base-metal veins (fig. 6A). These veins are herein referred to as Big, Excelsior, Jacob Straeder, Domingo, and Richmond (figs. 6A, B, C, D; tables 4, 5, 6, 7).

The Big and Excelsior base-metal veins (fig. 6B) were mined in the 1880's in Baxter Basin. Both veins consist primarily of sulfides in quartz and calcite gangue (tables 5 and 6). As in other veins near the Oh-Be-Joyful area, blackjack sphalerite is more plentiful than pyrite, which is more plentiful

than galena. Chalcopyrite is present only in small quantities. Sphalerite has been left on the dumps. Commonly, only hand-sorted lead-silver ore was shipped in the 1880's because zinc was penalized at most smelters. The Big and Excelsior veins probably intersect under the rock glacier in Baxter Basin (fig. 6A).

Workings on the Jacob Straeder vein (fig. 6A) under the east face of Richmond Mountain are flooded, but the vein is exposed in the cliff above. Where accessible, the vein is composed of sandy gouge, showing quartz and pyrite. Both vein and dump contain more than 2 oz silver per ton (table 4).

The Domingo vein was mined at the base of cliffs high on the north face of Richmond Mountain (fig. 6A). The mine portal and dump are covered by talus funneled through a deep gulley in which the vein crops out. The vein is composed of quartz, sphalerite, and pyrite, and contains considerable silver (table 4). This mineralization is also present 20 ft from the buried portal at what may have been a shallow powder-storage adit.

The Richmond vein, farther northwest, is exposed along a 360-ft drift (fig. 6B) as well as 200 ft above at the collar of a raise to the surface. The vein is brecciated quartz, with only traces of sulfides and small to moderate amounts of silver (table 7).

Workings on the southeast side of Richmond Mountain, inside the study area, are caved, but the dump contains the same minerals as the Big, Excelsior, Jacob Straeder, Domingo, and Richmond veins. A probable source for these veins is under Richmond Mountain, and could be partly within the wilderness study area. Small identified silver-zinc-lead resources are in these veins, and inferred resources could extend into the Oh-Be-Joyful study area. According to the model presented (p. 9-10), an associated molybdenum resource would be partly within the study area.

Augusta vein

The Augusta Mine, about 1 mi north of the study area (pl. 1; table 1) is largely inaccessible because of bad air and caved portals. Surface workings expose a base-metal vein near the top of Augusta Mountain. Compared to the veins previously described, the Augusta vein contains more galena and less sphalerite, more gold, and possibly, more silver. Molybdenite is visible in at least one prospect. The northeast projection of the vein, in Proverty Gulch, appears to be several thin veins containing silver, quartz, arsenopyrite, and minor galena and sphalerite. The precious and base-metal resource in the Augusta vein does not appear to extend into the study area.

Oh-Be-Joyful headwaters

The crest of the Ruby Range, from Ruby Peak (just off the map south of Mt. Owen) to Augusta Mountain, is weakly mineralized along the entire 5 mi distance (fig. 7A). The best exposed vein--the Ruby No. 1--is a sulfide vein in Democrat Basin where it was followed 420 ft southwestward in an adit (fig. 7B). The Ruby No. 1 vein crops out about 400 ft southwest of the face of the adit about 400 ft upslope from the adit. The vein is narrow and locally pinches out, but sparse metal values are in the wall rock adjacent to the vein. The mineralogy is similar to the other sulfide veins described. A small identified silver-zinc-lead resource exists in the Ruby No. 1 vein entirely within the study area.

Dippold and Little Silver Basins, near the crest of the Ruby Range, contain a number of shallow prospects (fig. 7A). Prospects in Dippold Basin have neither gold nor silver, but a few tens of parts per million molybdenum is present. Similar prospects in Little Silver Basin, just south of Dippold Basin, contain gold and silver, but no molybdenum (table 8). The mineralization described at the Ruby No. 1 vein, in Dippold Basin, and in Little Silver

Basin could indicate zoning over and around a center of mineralization below Dippold Basin.

The structural complexity along the crest of the Ruby Range is not fully shown on the geologic map (Gaskill and others, 1967), nor described herein. Although pervasive, the mineralization was weak, and not cause for extensive exploration; consequently a very limited picture was available for study. Bureau of Mines evidence, by itself, is insufficient to identify any resource in the Oh-Be-Joyful headwaters part of the study area except for the small resource mentioned in the Ruby No. 1 vein.

Miscellaneous prospects

Many prospects (pl. 1; figs. 4A, 5A, 6A, 7A, 7B, 8; tables 9, 10) show evidence of mineralization, but have not been discussed because their relationship (if any) to the overall assessment of mineral resources is not clear.

Production data

Most of the recorded production from the Ruby district (table 1) occurred after 1901 and before 1969. Total recorded production for that part of the district discussed in this report was about 24,000 oz of gold, 5.2 million oz of silver, 6.6 million lb of copper, 30.9 million lb of lead, 55.2 million lb of zinc, and a few pounds of cadmium.

Between 1884 and 1954 the coal mines within 4 mi of the study area produced about 3 million tons of coal (Gaskill and others, 1967).

Resources

Inferred coal resources, in beds 1 to 3 ft thick, are 12 million tons, within the study area. Less than half of this coal resource is recoverable by current technology.

The indicated silver-zinc-lead resource within the study area is about 10,000 tons, averaging 0.6 oz silver per ton, 1.0 percent lead, and 1.4 percent zinc. The inferred silver-zinc-lead resource is about 400,000 tons of a similar grade.

CONCLUSIONS

The Oh-Be-Joyful Wilderness Study Area has small indicated resources of silver-zinc-lead in the Independence and Ruby No. 1 veins, and moderate-size inferred resources in the same veins. Silver-zinc-lead inferred resources exist under Richmond Mountain, and may exist elsewhere along the Ruby Range and related to the Scarp vein in Peeler Basin.

A molybdenum deposit probably exists under Oh-Be-Joyful Creek on the eastern boundary of the study area, because the structure, mineral zoning, and alteration fit the Mount Emmons-Keystone and Redwell Basin-Micawber model, and because molybdenum was found in a drill hole in the Oh-Be-Joyful Creek area. A molybdenum deposit is probably associated with the inferred silver-zinc-lead resources under Richmond Mountain on the northwest corner of the study area, although the evidence does not fit the established model as well as does the evidence for the deposit under Oh-Be-Joyful Creek. Both deposits may be partly within the study area.

Small- to moderate-size identified coal resources are present in the study area.

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Table 1.--Summary of information regarding metallic mineral deposits in and near the Oh-Be-Joyful Wilderness Study Area

Deposit and location	Commodities	Geology: Setting	Geology: Control	Geology: Known size	Development	Production[1]	Reserves/Resources[1]
Augusta Mine, sec. 33, T. 12 S., R. 87 W.	Ag, Au, Cu, Pb, Zn.	Quartz monzonite Augusta stock and Mancos Shale.	Vein striking N. 65-70° E., dipping 80° SE.	1,500 ft along strike, 1,500 ft down dip, 10-20 ft wide.	6 levels, 2,500-ft crosscut, over 3,000 ft of drifts. Operated 1883 to 1937, mainly before 1905.	Large Ag, Au, small Pb, Zn, Cu.	Unknown, but probable small to moderate size.
Big Mine, sec. 3, T. 13 S., R. 87 W.	Ag, Cu, Pb, Zn.	Mesaverde Formation	Vein striking N. 40-70° E., dipping vertically, open space filling.	1,700 ft along strike, 500 ft down dip, up to 4 ft wide.	240-ft adit with 60-ft shaft, 180 ft+ adit and winze, caved shaft. Operated about 1880 to 1920.	Unknown, probably moderate Ag, small Pb.	Moderate size indicated and inferred.
Daisy Mine, sec. 30, T. 13 S., R. 86 W.	Ag, Au, Cu, Pb, Zn.	Mesaverde Formation near Redwell Basin felsite plug.	Arcuate vein striking N. to N. 25° W., dipping about 35° W., locally along bedding planes, open space filling with minor replacement.	1,000 ft along strike, 100 ft down dip, up to 40 ft wide.	500-ft adit, stope and 2 raises, winze (prior to 1950). Operated 1887 to 1967, mainly from 1950 to 1967.	Large Ag, moderate Pb, Zn, small Au, Cu.	Unknown, but probable moderate size.
Domingo Mine, sec. 3, T. 13 S., R. 87 W.	Ag, Au, Pb, Zn.	Quartz monzonite Augusta stock.	Vein striking N. 30° W., dipping vertically.	Unknown, estimated strike length over 500 ft, traceable over 100 ft up dip.	Inaccessible, estimated 300-ft adit. Probably operated before 1900.	Small Ag, Au, Pb, Zn, Cu known.	Unknown, but probable small to moderate size.
Excelsior Mine, sec. 3, T. 13 S., R. 87 W.	Ag, Au, Pb, Zn.	Mesaverde Formation	Vein striking N. 60° E., dipping 60° NW., open space filling.	1,000 ft or more along strike, 200 ft down dip, less than 1 ft wide.	170-ft adit with winze, 1,200-ft adit driven to cut the vein down dip did not.	Moderate Ag, small Pb, Cu, Au.	Small subeconomic indicated and inferred.
Forest Queen Mine, sec. 2, T. 14 S., R. 87 W.	Ag	Wasatch Formation and porphyry sill.	Vein striking N. 40° E., dipping 80° SE., may be in same fault as Micawber vein.	1,700 ft along strike, 500 ft down dip, 10-20 ft wide.	9 levels, 3 shafts, 7,300 ft of drifts. Operated 1875 to present, mainly 1879 to 1897.	Large Ag, moderate Au, small Pb, Cu.	Probable moderate size.
Independence vein, secs. 25, 26, 34, 35, T. 13 S., R. 87 W.	Ag, Pb, Zn	Mancos Shale, Mesaverde Formation, Ohio Creek Formation, Wasatch Formation, quartz monzonite sill.	Vein striking N. 60° E., dipping vertically, open space filling.	2.4 mi along strike, 2,100 ft down dip, up to 4 ft wide.	5 adits (3 caved) 50-ft and 160-ft accessible, 3 shafts, several pits, probably operated before 1900.	Small Ag, Pb, Zn known.	Small indicated, moderate size inferred.
Keystone Mine, sec. 31, T. 13 S., R. 86 W., sec. 6, T. 14 S., R. 86 W.	Ag, Au, Cd, Cu, Pb, Zn.	Mesaverde Formation, intersecting Mt. Emmons Mo deposit.	2 parallel veins striking N. 20-40° W., dipping 50-70° SW., open space filling.	Keystone Vein over 3,000 ft along strike, 1,200 ft down dip, 1-10 ft wide. Union vein 2,000 ft along strike, 300 ft down dip, 1-10 ft wide. Structure is traceable about 2 mi along strike and 2,700 ft down dip.	5 levels and 5 sublevels, over 20,000 ft of drifts. Operated 1890 to 1975, mainly 1955 to 1967.	Large Ag, Au, Zn, Pb, Cu, small Cd.	Unknown, but probable moderate to large.
Mount Emmons deposit, sec. 31, T. 13 S., R. 86 W.	Mo	Granitic cupola intruded into Mancos Shale and Mesaverde Formation.	Porphyry-type disseminated mineralization.	About 2,000 ft diameter.	31 holes drilled 1976 to 1981.	None	165 million tons of 0.43 percent MoS_2.
Micawber (Standard) Mine, sec. 36, T. 13 S., R. 87 W.	Ag, Au, Cu, Pb, Zn.	Wasatch Formation hangingwall, Ohio Creek Formation footwall, intersects Redwell Basin Mo deposit.	Vein striking N. 65° E., dipping 65-80° SE., open space filling.	3,000 ft along strike, 600 ft down dip. Structure is traceable 8,000 ft along strike and 1,000 ft down dip.	6 levels, 8,400 ft of drifts. Operated 1931 to 1966, mainly 1951 to 1966.	Large Ag, Zn, Pb, moderate Au, Cu.	Unknown, but probable small to moderate size.
Redwell Basin deposit, sec. 30, T. 13 S., R. 86 W. sec. 25, T. 13 S., R. 87 W.	Mo	Granitic cupola intruded into Mancos Shale and Mesaverde Formation.	Porphyry-type disseminated mineralization.	1,000-2,000 ft across.	27 drill holes drilled 1967 to 1980.	None	Upper body: 19 million tons 0.18 percent MoS_2. Lower body not fully defined.
Richmond Mine, sec. 4, T. 13 S., R. 87 W.	Ag	Mancos Shale and Mesaverde Formation.	Vein striking N. 30° W., dipping vertically, open space filling.	400 ft along strike, 200 ft down dip, less than 2 ft wide.	200-ft crosscut, 300-ft drift on main level, winze with 2 levels, 2 raises.	Unknown, probable small Ag.	Small indicated and inferred.
Ruby No. 1 claim, sec. 10, T. 13 S., R. 87 W.	Ag, Pb, Zn	Mesaverde Formation	Vein striking N. 50° E., dipping vertically, open space filling.	800 ft along strike, 400 ft down dip, less than 1 ft wide.	480-ft adit. Operated 1930 to 1966.	Small Ag, Au, Pb, Zn	Small indicated and inferred.
Scarp vein, sec. 26-28, T. 13 S., R. 87 W.	Ag, Pb, Zn	Ohio Creek Formation and Wasatch Formation.	Fault striking N N. 80° E., dipping vertically.	1.6 mi along strike, 1,300 ft down dip.	2 shafts, 2 caved adits, several pits. Probably operated before 1900.	Unknown, probable small Ag.	Small indicated and inferred.

[1]For purposes of this report these definitions are used:

small production or reserves:
- Ag - less than 1,000 oz
- Au - less than 100 oz
- Cu, Cd, Pb, Zn - less than 100,000 lb

moderate production or reserves:
- Ag - 1,000-10,000 oz
- Au - 100-1,000 oz
- Cu, Pb, Zn - 100,000-1 million lb

large production or reserves:
- Ag - more than 10,000 oz
- Au - more than 1,000 oz
- Cu, Pb, Zn - more than 1 million lb

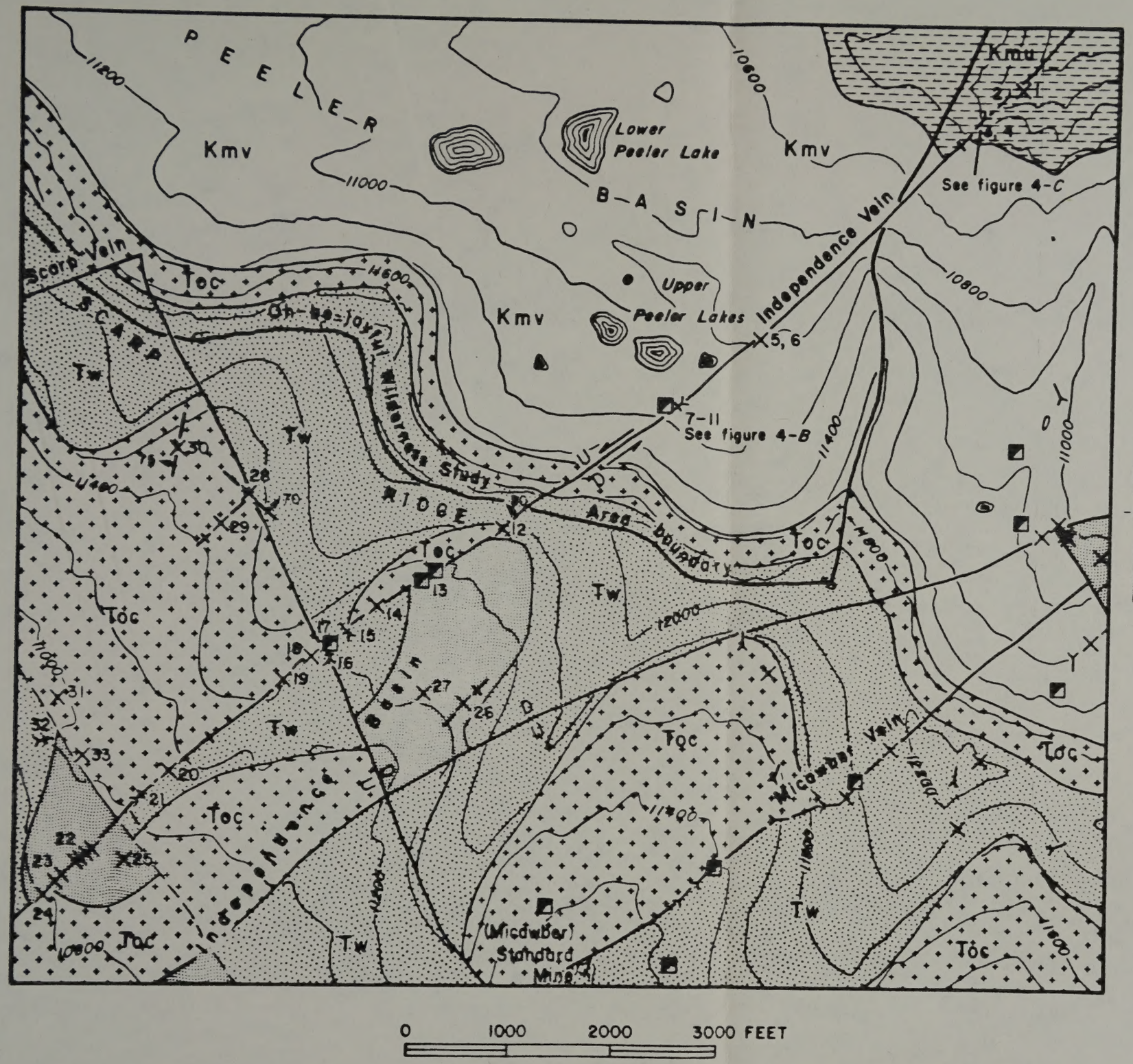
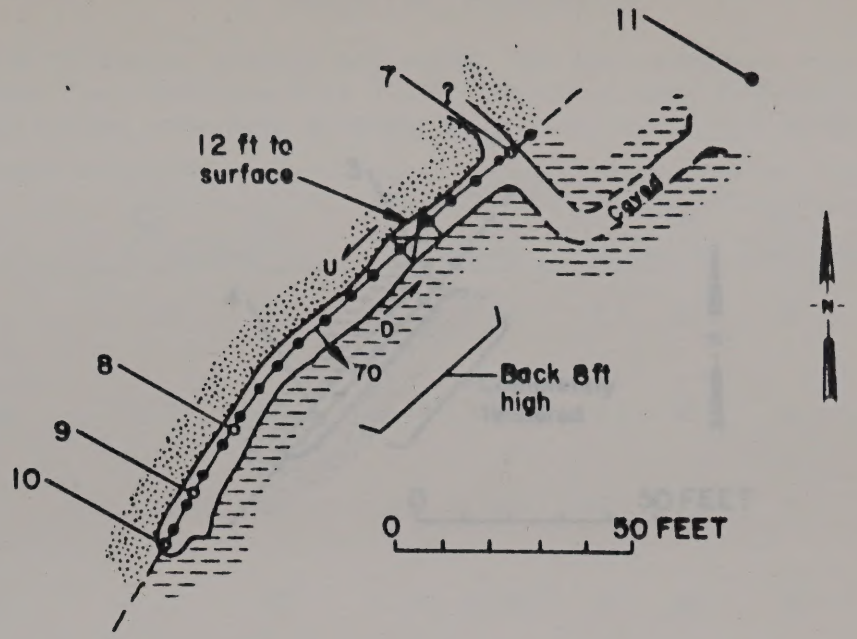
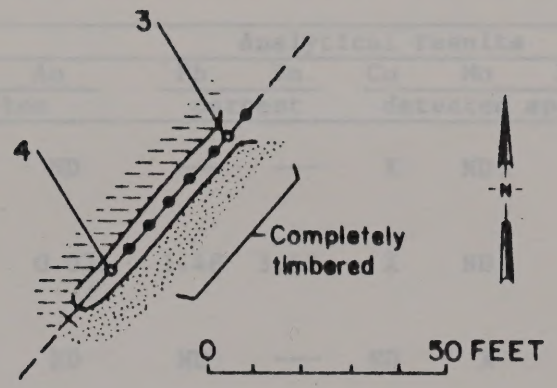


Figure 4A.--Simplified geologic map of the Independence vein area (adapted from Gaskill and others, 1967) showing sample localities 1-33.



Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Remarks
7	2-ft chip, 6-in. vein.	ND	ND	0.14	0.28	X	ND	ND	X	
8	2-ft chip, 20-in. vein.	1.9	ND	4.10	2.50	X	ND	X	X	Galena, sphalerite.
9	1 1/2-ft chip, 1-ft vein.	.4	ND	.34	1.20	X	ND	X	X	Do.
10	3-ft chip, 1-ft vein.	1.0	ND	2.69	2.50	X	ND	X	X	Do.
11	Dump.	.2	ND	.86	1.40	X	ND	X	X	Do.

Figure 4-B.--Peeler Basin adit map, showing sample localities 7-11, and table showing analytical data for samples.



Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
3	4-ft chip, 4-ft vein.	1.9	ND	1.37	5.80	X	ND	X	X	Cd, Sn	Gouge with pyrite.
4	3-ft chip, 2-ft vein.	.6	ND	.66	2.40	X	ND	X	X	Sn	Do.

Figure 4-C.--Peeler Falls adit map, showing sample localities 3-4, and table showing analytical data for samples.

Table 2.--Data for samples on Independence vein area map, excluding samples from Peeler Falls and Peeler Basin adits

[On all sample-data tables the following symbols are used: ND, not detected; ---, not tested for; X, detected; Tw, Tertiary Wasatch Formation; Toc, Tertiary Ohio Creek Formation; Kmv, Cretaceous Mesaverde Formation; Kmu, Cretaceous Mancos Shale; qmp, quartz monzonite porphyry or similar intrusive rock]

Sample		Analytical results									Remarks
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	
No.	Description	oz/ton		percent		detected spectrographically					
1	3-ft chip	ND	ND	---	---	X	ND	X	ND	Ni	Kmu shale, barren.
2	1-ft chip, 1-ft vein, cave in falls.	0.9	0.036	1.48	3.60	X	ND	X	X	Sn	Kmu sandstone.
5	Dump, water-filled pit.	.2	ND	ND	---	ND	X	X	ND		Kmv sandstone.
6	Stockpile from above pit.	1.0	ND	4.30	5.40	X	ND	X	X	Cd	Quartz and calcite gangue.
12	3-ft chip, vein	.9	ND	---	---	X	ND	ND	X		Tw sandstone.
13	Dump, two shafts	.9	ND	.72	---	ND	ND	ND	X		Toc sandstone.
14	3 1/2-ft chip, vein	ND	ND	---	---	X	ND	X	X		Do.
15	Dump, caved adit	.2	ND	.46	.15	X	ND	ND	ND		Do.
16	Stockpile, caved adit	.3	ND	.74	.69	X	X	ND	ND		Do.
17	5-ft chip, vein outcrop by shaft.	ND	ND	---	---	X	X	X	X		Do.
18	Dump, caved pit	.1	ND	---	---	ND	X	X	X		Do.
19	Do.	.1	.02	---	---	X	ND	X	X		Do.

Table 2.--Data for samples on Independence vein area map, excluding samples from Peeler Falls and Peeler Basin adits--Continued

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
20	Dump, 10-ft pit	0.5	0.01	---	---	X	X	X	X		Toc sandstone.
21	Dump, caved adit	.3	.02	---	---	X	ND	X	X		Do.
22	Dump, 4 pits	ND	ND	---	---	X	X	X	X		qmp
23	Dump, 2 pits	.6	.02	---	---	X	ND	X	X		Do.
24	Dump, caved pit	.1	.01	---	---	ND	X	ND	X		Do.
25	Do.	ND	.03	---	---	ND	X	ND	X		qmp and Tw sandstone.
26	5 1/2-ft chip, fault, N. 45° W., vertical.	.1	ND	---	---	ND	ND	X	X		qmp
27	Specimen, caved pit	.1	ND	---	---	ND	X	X	X		Do.
28	2-ft chip, fault, N. 40° W., dip 70° NE.	.6	.01	---	---	X	ND	X	ND		Toc sandstone.
29	Dump, 12-ft pit, fault, N. 45° W., dip vertical.	ND	ND	---	---	ND	X	ND	ND		Do.
30	8-ft chip, fault, N. 10° E., dip 75° NW.	.1	ND	---	---	ND	X	ND	ND		Do.
31	Dump, water-filled pit	.1	ND	---	---	ND	X	ND	ND		Do.
32	Dump, caved adit	.1	.01	---	---	ND	X	ND	ND	Co	Do.
33	3-ft chip, N. 45° W., quartz veinlets.	.1	.01	---	---	ND	ND	ND	ND		Do.

Table 2.--Data for samples on Independence veins area map, excluding samples from Peeler Pails and Peeler Peals adits--Continued

Sample No.	Description	Analytical results									Remarks
		Ag	Au	Fe	Zn	Cu	Mo	Pb	Zn	Other detected spectrographically	
		ppm	ppm	percent							
20	Dump, 10-ft pit	0.5	0.01	---	---	X	X	X	X		Tor andesites.
21	Dump, caved adit	.3	.02	---	---	X	ND	X	X		Do.
22	Dump, 4 pits	ND	ND	---	---	X	X	X	X		Dep
23	Dump, 2 pits	.6	.02	---	---	X	ND	X	X		Do.
24	Dump, caved pit	.1	.01	---	---	ND	X	ND	X		Do.
25	Do.	ND	.01	---	---	ND	X	ND	X		Dep and Tr andesites.
26	3 1/2-ft chip, fault, N. 45° W., vertical.	.1	ND	---	---	ND	ND	X	X		Dep
27	Spectacle, caved pit	.1	ND	---	---	ND	X	X	X		Do.
28	5-ft chip, fault, N. 80° W., dip 70° NE.	.6	.01	---	---	X	ND	X	ND		Tor andesites.
29	Dump, 12-ft pit, fault, N. 85° W., dip vertical.	ND	ND	---	---	ND	X	ND	ND		Do.
30	5-ft chip, fault, N. 10° E., dip 75° NW.	.1	ND	---	---	ND	X	ND	ND		Do.
31	Dump, water-filled pit	.1	ND	---	---	ND	X	ND	ND		Do.
32	Dump, caved adit	.1	.01	---	---	ND	X	ND	ND	Ga	Do.
33	3-ft chip, N. 45° W., quartz veinlets.	.4	.01	---	---	ND	ND	ND	ND		Do.

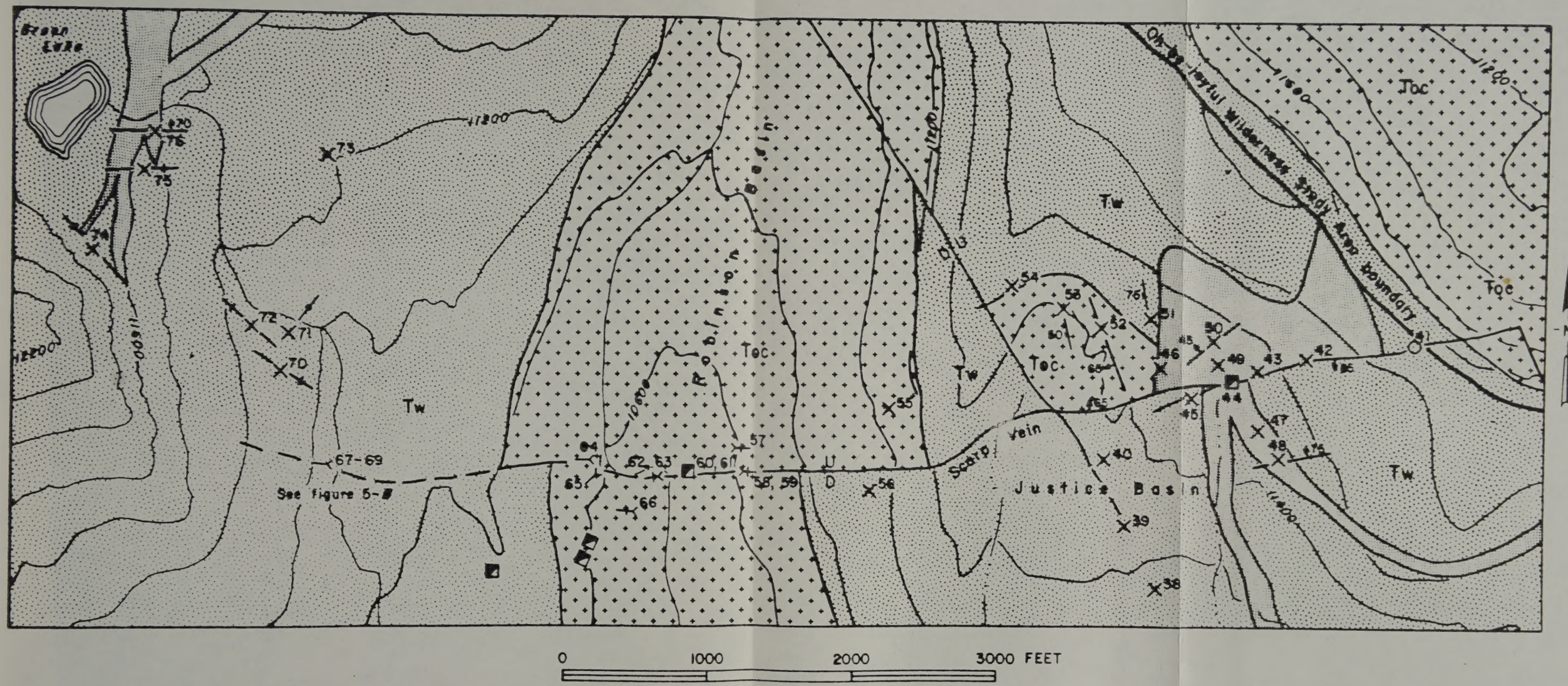
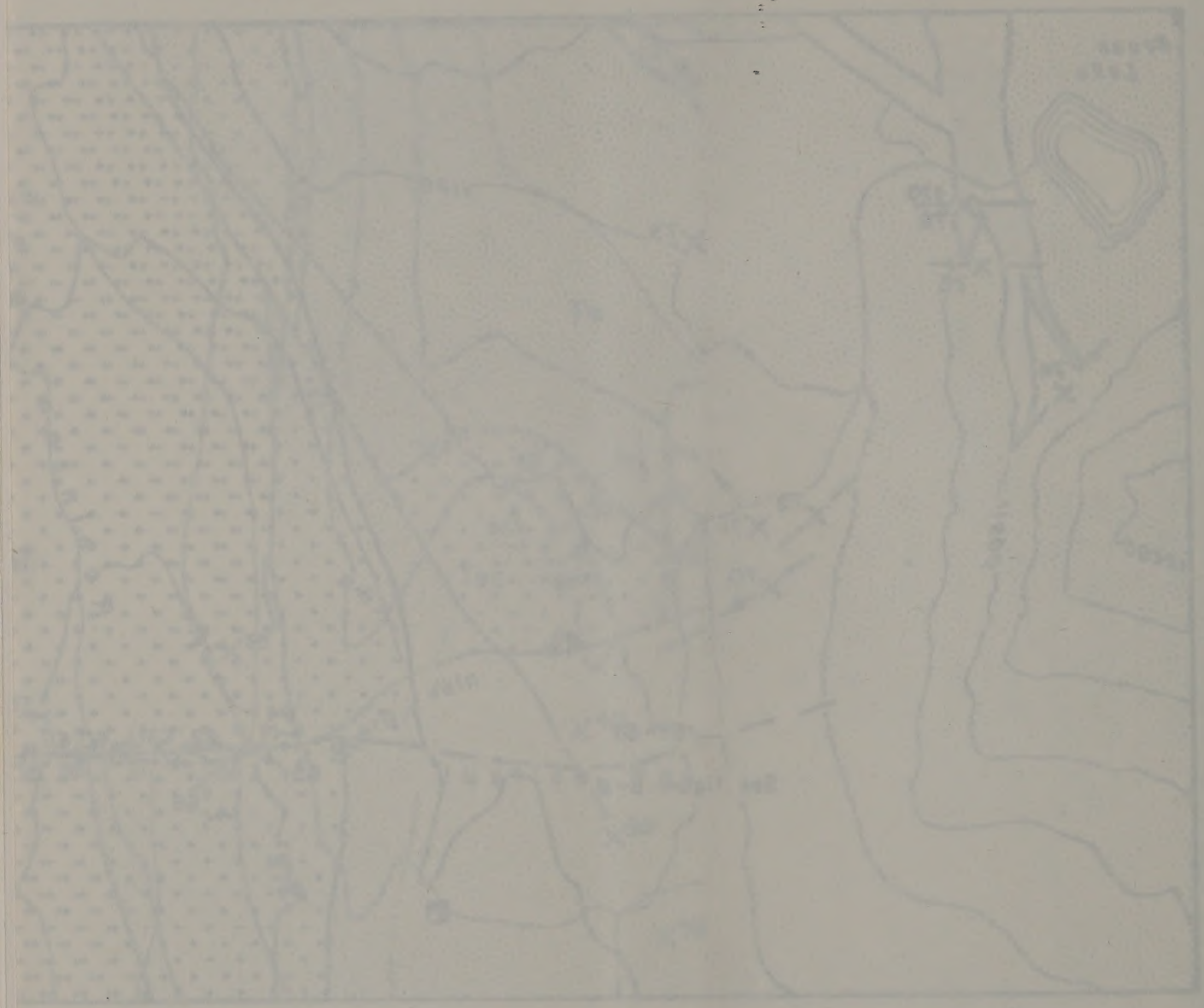
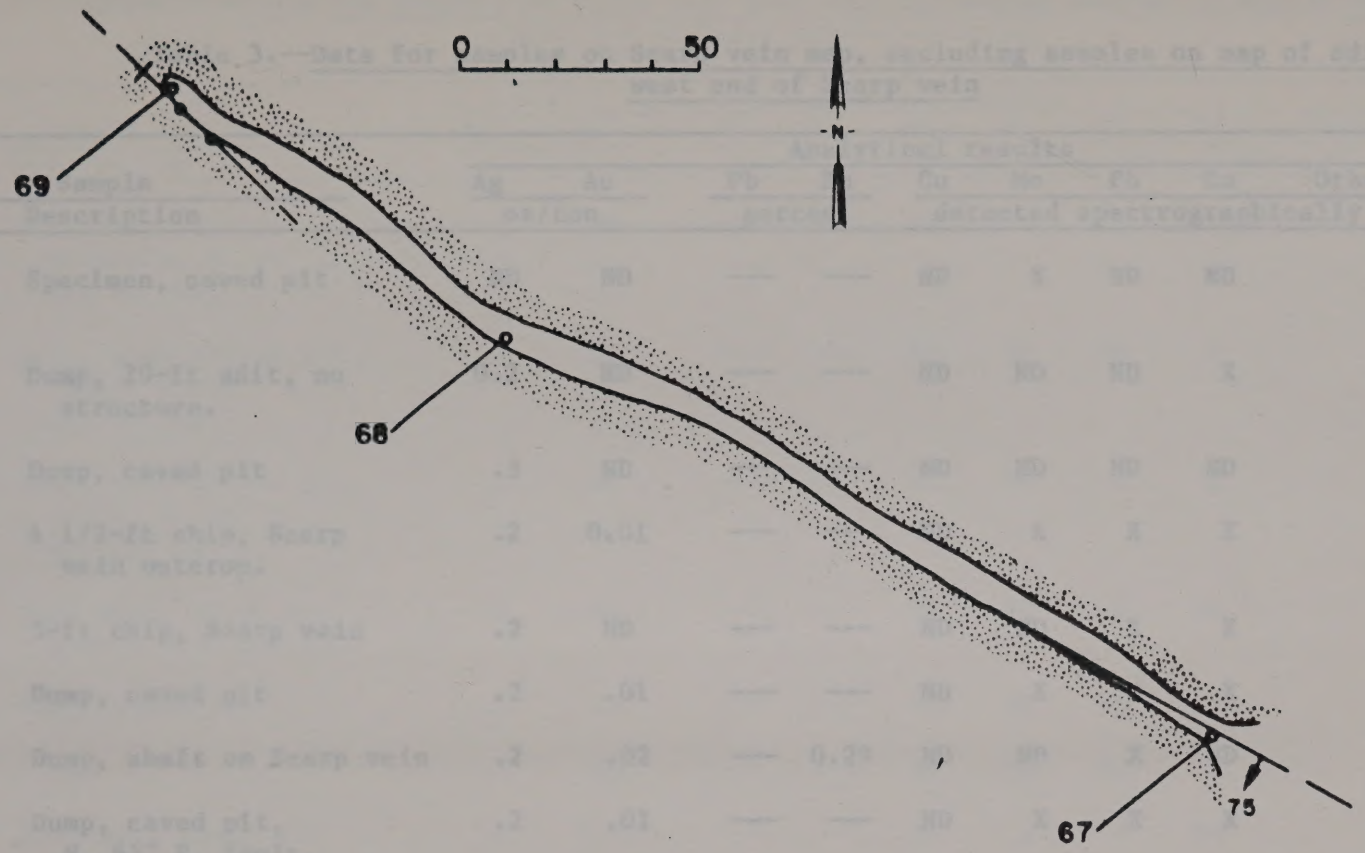


Figure 5A.--Simplified geologic map of Scarp vein area (adapted from Gaskill and others, 1967) showing sample localities 38-76.





Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Remarks
67	3 1/2-ft chip, fault.	0.1	ND	---	---	ND	ND	ND	X	Tw, may be on Scarp vein.
68	3-ft chip, no structure.	ND	ND	---	---	ND	X	ND	X	Do.
69	3-ft chip, 1-ft vein.	ND	0.02	---	---	ND	ND	ND	X	Do.

Figure 5-B.--Map of adit on west end of the Scarp vein, showing sample localities 67-69, and table showing analytical data for samples.

Table 3.--Data for samples on Scarp vein map, excluding samples on map of adit on west end of Scarp vein

Sample		Analytical results									Remarks
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	
No.	Description	oz/ton		percent		detected spectrographically					
38	Specimen, caved pit	ND	ND	---	---	ND	X	ND	ND		Tw, quartz and pyrite.
39	Dump, 20-ft adit, no structure.	0.2	ND	---	---	ND	ND	ND	X		Tw
40	Dump, caved pit	.3	ND	---	---	ND	ND	ND	ND		Do.
41	4 1/2-ft chip, Scarp vein outcrop.	.2	0.01	---	---	ND	X	X	X		Do.
42	5-ft chip, Scarp vein	.2	ND	---	---	ND	ND	X	X		qmp north of Tw.
43	Dump, caved pit	.2	.01	---	---	ND	X	X	X		Tw
44	Dump, shaft on Scarp vein	.2	.02	---	0.29	ND	ND	X	ND		qmp
45	Dump, caved pit, N. 65° E. fault.	.2	.01	---	---	ND	X	X	X		Tw
46	Dump 50-ft adit, no structure.	.1	ND	---	---	ND	ND	ND	X		qmp
47	Dump, snow-filled pit	.1	ND	---	---	ND	X	ND	X		Do.
48	Dump, 30-ft pit, fault, N. 80° E., dip 75° N.	.2	ND	---	---	ND	X	ND	X		Do.
49	Dump, pit on irregular quartz veinlets.	ND	.01	---	---	ND	ND	X	X		Do.

Table 3.--Data for samples on Scarp vein area map, excluding samples on map of adit on west end of Scarp vein--Continued

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
50	6-ft chip, quartz veinlets, N. 50° E., dip 45° NW.	0.1	ND	---	---	ND	X	X	X		qmp
51	Dump, snow-filled pit, fault, N. 10° W., dip 75° NW.	.1	ND	---	---	ND	ND	ND	X		Tw
52	Dump, snow-filled pit, fault, N. 25° W., dip 65° SW.	.1	ND	---	---	ND	ND	X	X		Toc
53	3-ft chip, N. 5° W., joints with quartz.	.1	ND	---	---	ND	ND	X	ND		Do.
54	Dump, caved pit	.1	ND	---	---	ND	ND	ND	X		Base of Tw.
55	Do.	.2	ND	---	---	ND	ND	ND	X		Tw
56	Specimen, caved pit	.2	0.01	---	---	ND	X	X	ND		Tw, quartz and pyrite.
57	Dump, caved adit	ND	ND	---	---	ND	ND	X	X		Toc
58	Stockpile, caved adit on Scarp vein.	.2	ND	1.1	---	X	ND	ND	ND		Toc, quartz gangue.
59	Dump, above adit	.3	ND	---	---	ND	ND	X	X	Sn	Toc
60	3-ft chip, shaft on Scarp vein.	ND	ND	---	---	ND	ND	X	X		Do.
61	Dump, above shaft	1.8	.09	1.7	0.11	ND	ND	X	X		Quartz and calcite.

Table 3.--Data for samples on Scarp vein area map, excluding samples on map of adit on west end of Scarp vein--Continued

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
62	Stockpile, caved adit on Scarp vein.	3.4	0.07	1.2	0.48	X	ND	X	X		Quartz and calcite.
63	Dump, above adit	1.1	.04	---	---	ND	ND	X	X		Toc and Tw.
64	2-ft chip, fault, E-W., dip vertical.	ND	.03	---	---	ND	ND	X	X		Water-filled adit, Tw.
65	2-ft chip, faults, N. 70° E. & N. 35° E.	ND	ND	---	---	ND	X	X	X		Do.
66	Dump, caved adit	ND	.03	---	---	ND	X	X	X	Sn	Tw
70	Dump, pit, N. 60° W., fault, dip vertical.	.2	ND	---	---	ND	ND	ND	X		Quartz vein in Tw.
71	2-ft chip, joints, N. 37° E.	.1	ND	---	---	ND	ND	ND	X		Tw
72	Dump, pit, N. 50° W., fault.	.1	ND	---	---	ND	ND	ND	X		Do.
73	Do.	ND	ND	---	---	ND	X	ND	X		Do.
74	2 1/2-ft chip, fault, N. 40° W.	.1	ND	---	---	ND	ND	X	X		Do.
75	2-ft chip, fault, E-W., dip vertical.	.2	ND	---	---	ND	X	ND	X		Tw, 10-ft adit.
76	2-ft chip, fault, E-W., dip 70° N.	.2	ND	---	---	ND	X	ND	X		qmp

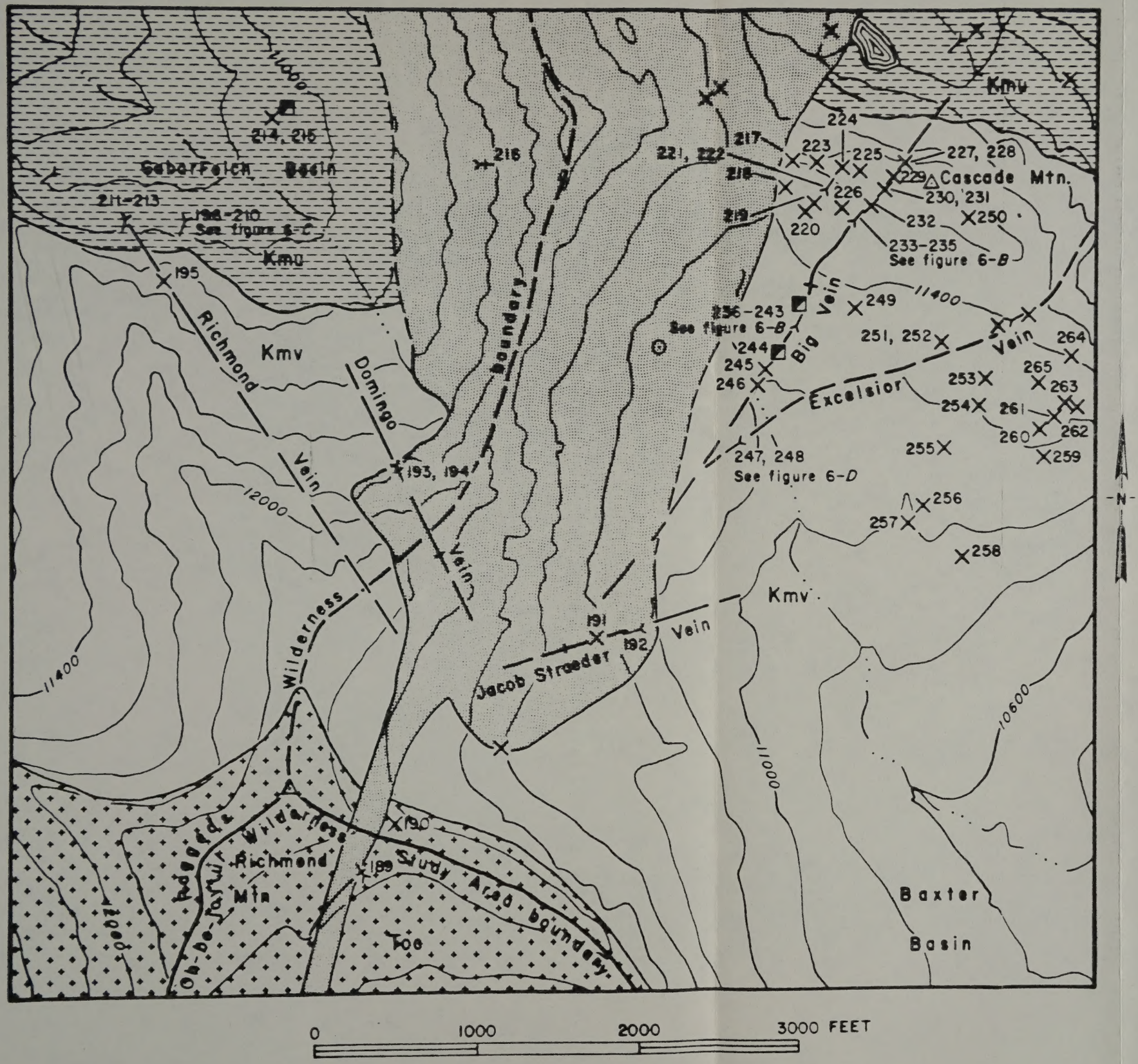
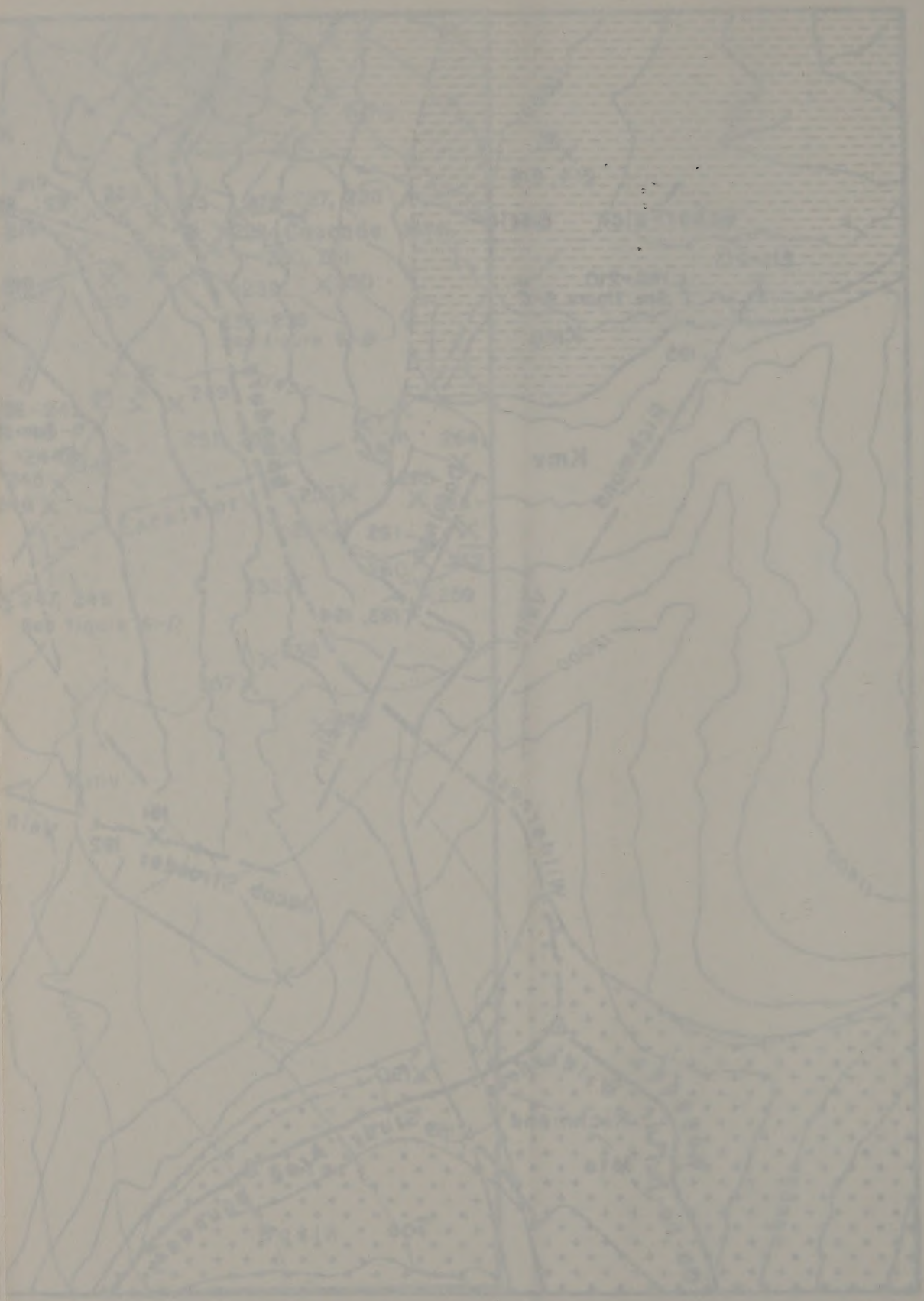


Figure 6A.--Simplified geologic map of Richmond Mountain area (adapted from Gaskill and others, 1967) showing sample localities 189-265.



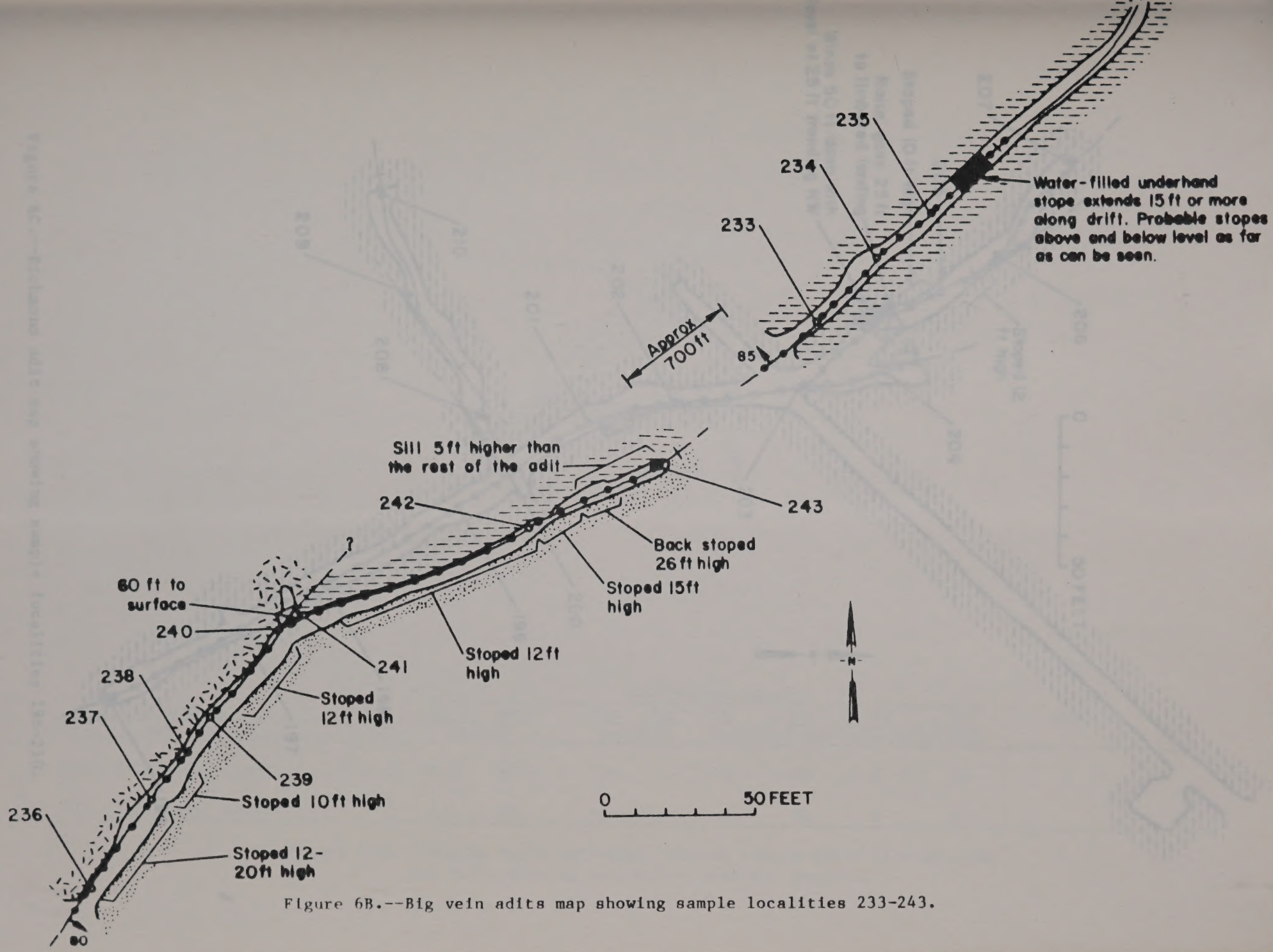


Figure 6B.--Big vein adits map showing sample localities 233-243.

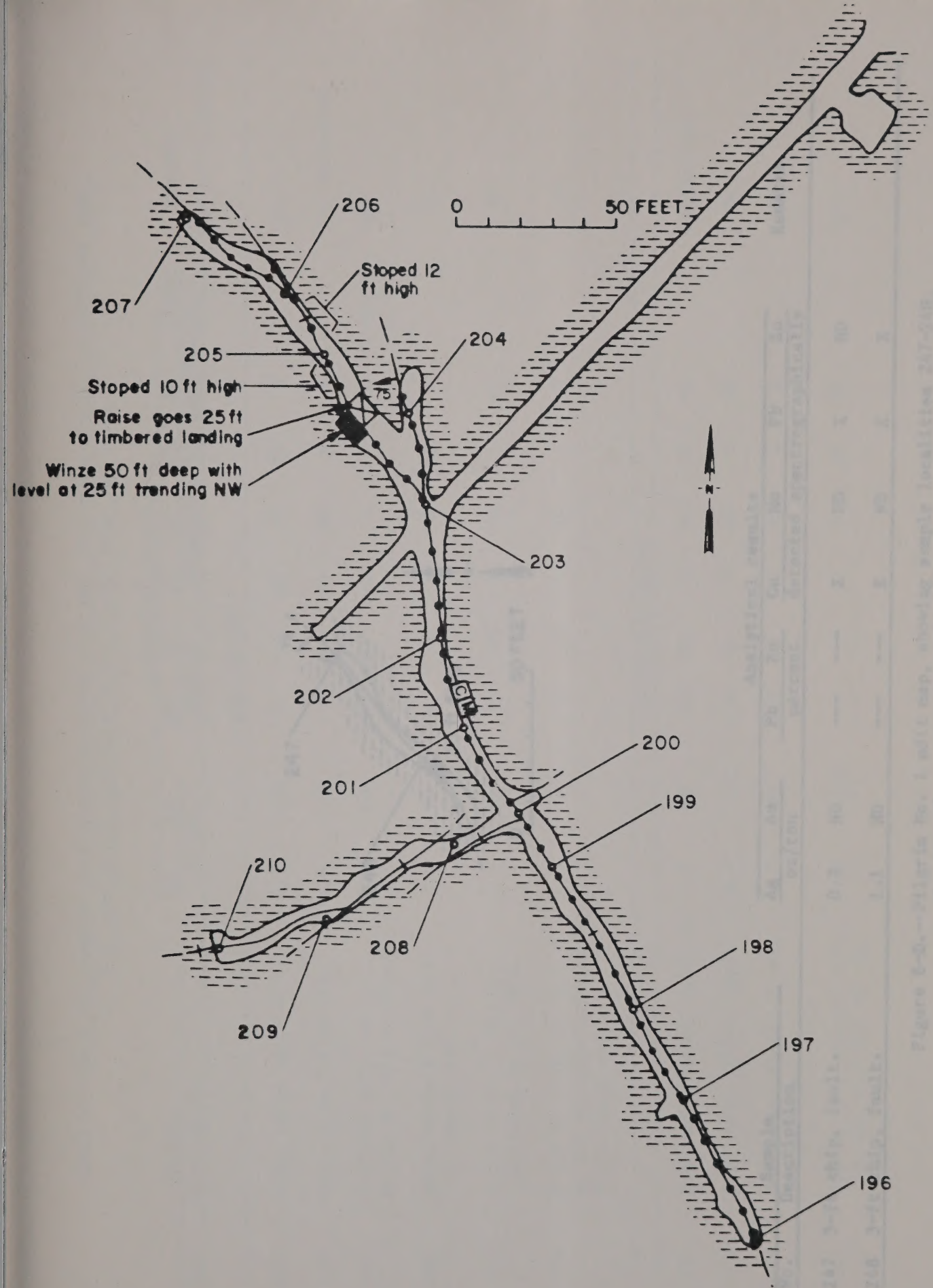
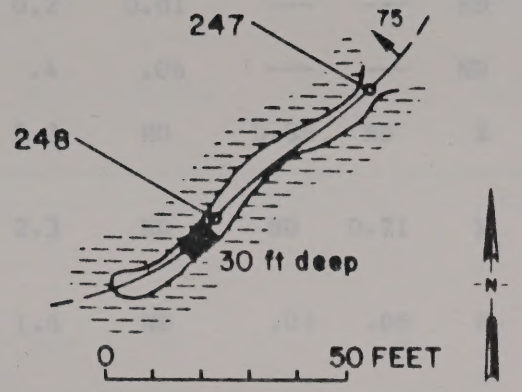


Figure 6C.--Richmond adit map showing sample localities 196-210.



Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Remarks
247	3-ft chip, fault.	0.2	ND	---	---	X	ND	X	ND	
248	3-ft chip, fault.	1.1	ND	---	---	X	ND	X	X	

Figure 6-D.--Pilgrim No. 1 adit map, showing sample localities 247-248, and table showing analytical data for samples.

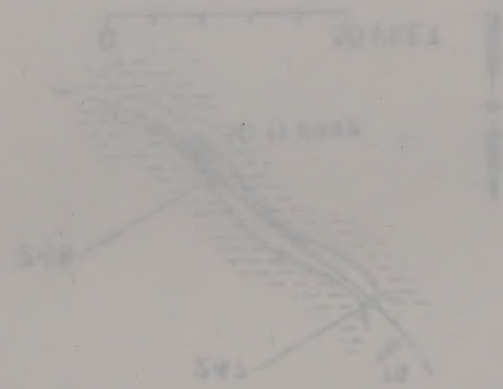


Table 4.--Data for samples on Richmond Mountain area map, excluding samples on Richmond adit, Big vein adits, and Pilgrim No. 1 adit maps and table 5

Sample		Analytical results									Remarks
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	
No.	Description	oz/ton		percent		detected spectrographically					
					RICHMOND MTN						
189	Dump, caved adit.	0.2	0.01	---	---	ND	ND	ND	X		qmp
190	Dump, snow-filled pit.	.4	.06	---	---	ND	ND	X	X		Toc sandstone
191	1 1/2-ft chip, vein, N. 75° E., dip vertical.	3.3	ND	0.88	ND	X	X	X	X	As, Sb	qmp
192	Dump, water-filled adit on above vein.	2.3	ND	ND	0.21	X	ND	ND	X		Do.
193	1 1/2-ft chip, veinlet parallel to no. 194.	1.6	ND	.03	.06	X	ND	X	ND		Do.
194	2 1/2-ft chip, vein, N. 25° W., dip vertical, above caved adit.	26.8	.076	.34	.40	X	ND	X	X		Do.
					GABARFEICH BASIN						
211	2-ft chip, fault, N. 5° W.	.7	ND	.80	ND	X	ND	ND	ND		Kmu hornfels
212	2-ft chip, 20-in. fault.	4.3	.156	1.36	ND	X	ND	X	ND		Do.
213	2-ft chip, fault, E.-W., dip 70° N.	.3	ND	.03	ND	X	ND	X	X		Do.
214	1/2-ft chip, quartz vein, N. 60° E., dip 70° NW.	ND	.018	---	---	X	ND	ND	ND		qmp

Table 4.--Data for samples on Richmond Mountain area map, excluding samples on Richmond adit, Big vein adits, and Pilgrim No. 1 adit maps and table 5

Sample No.	Description	Analytical results										
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Is	Other	Remarks
		oz/ton		percent		detected spectrographically					
	RICHMOND MTN										
189	Dump, caved adit.	0.2	0.01	---	---	---	ND	ND	ND	X	dup
190	Dump, snow-filled pit.	.4	.06	---	---	---	ND	ND	X	X	Tec reactions
191	1 1/2-ft chip, vein, N. 15° E., dip vertical.	3.3	ND	0.84	ND	?	?	?	X	As, Sb	dup
192	Dump, water-filled adit on above vein.	2.3	ND	ND	0.21	?	ND	ND	X		Do.
193	1 1/2-ft chip, material to no. 194.	1.6	ND	.01	.02	?	ND	?	ND		Do.
194	2 1/2-ft chip, vein, N. 23° W., dip vertical, above caved adit.	26.8	.075	.34	.60	?	ND	X	X		Do.
	CARIBOU MINE										
211	2-ft chip, fault, N. 5° W.	.7	ND	.80	ND	X	ND	ND	ND		Too heterele
212	2-ft chip, 20-in. fault.	4.1	.156	1.36	ND	X	ND	X	ND		Do.
213	2-ft chip, fault, E.-W., dip 70° N.	.3	ND	.03	ND	?	ND	?	X		Do.
214	1 1/2-ft chip, quartz vein, N. 50° E., dip 70° NW.	ND	.018	---	---	X	ND	ND	ND		dup

Table 4.--Data for samples on Richmond Mountain area map, excluding samples on Richmond adit, Big vein adits, and Pilgrim No. 1 adit maps and table 5--Continued

Sample No.	Description	Analytical Results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
	GABARFEICH BASIN--Continued										
215	1-ft chip, 7-in. fault, N. 65° E., dip 80° NW.	ND	ND	---	---	X	ND	ND	ND		Kmu shale
216	4-ft chip, fault, N. 75° W.	0.3	0.014	---	---	X	X	ND	ND		qmp
	Cascade Mtn										
217	4-ft chip, fault, N. 25° E.	ND	.010	---	---	X	ND	ND	ND	Cr, Ni	Kmv hornfels
218	5-ft chip, dike contact.	ND	ND	---	---	X	ND	X	ND		Kmv sandstone and qmp.
219	Dump, caved pit.	.2	ND	0.08	ND	X	ND	ND	ND		Kmv sandstone
220	Dump, caved prospect.	1.1	ND	ND	2.00	X	ND	X	X		Do.
221	2-ft chip, 8-in. fault, N. 20° W., 70-ft adit.	ND	ND	---	---	X	ND	ND	ND		Kmv sandstone and shale.
222	2-ft chip, 16-in. fault, brow of above adit.	.2	.024	---	---	X	ND	X	ND		Do.
223	2-ft chip, baked, oxidized shale.	.3	ND	---	---	X	ND	ND	ND	Cr, Ni	Kmv hornfels
224	5-ft chip, fault, N. 20° W.	.7	ND	---	---	X	ND	ND	ND		Do.
225	2-ft chip, heavy iron stain.	.8	.008	---	---	X	ND	ND	ND		Do.

Table 4.--Data for samples on Richmond Mountain area map, excluding samples on Richmond adit, Big Vein adits, and Pilgrim No. 1 adit maps and table 5--Continued

Sample No.	Description	Analytical Results: Ag (ppm)	Au (ppm)	Pb (percent)	Zn (percent)	Cu (percent)	Mo (percent)	Ib (percent)	Zn (percent)	other detected spectrographically	Remarks
CARBONATE BASIN--Continued											
215	1-ft chip, 7-in. fault, N. 85° E., dip 80° NW.	ND	ND	---	---	---	X	ND	ND	ND	Iron shale
216	4-ft chip, fault, N. 17° W.	0.3	0.014	---	---	---	X	X	ND	ND	Iron
Cresede Area											
217	4-ft chip, fault,	.1	.010	---	---	---	X	ND	ND	ND	Cr, Ni Rare bismutite
218	3-ft chip, dike contact.	ND	ND	---	---	---	X	ND	X	ND	Iron sandstone and qtz.
219	Dump, caved pit.	.2	ND	0.08	ND	X	ND	ND	ND		Iron sandstone
220	Dump, caved prospect.	1.1	ND	ND	2.00	X	ND	X	X		Do.
221	3-ft chip, 8-in. fault, N. 20° W., 70-ft adit.	ND	ND	---	---	X	ND	ND	ND		Iron sandstone and shale.
222	3-ft chip, 18-in. fault, brow of above adit.	.2	.024	---	---	X	ND	X	ND		Do.
223	3-ft chip, baked, oxidized shale.	.3	ND	---	---	X	ND	ND	ND	Cr, Bi	Iron bentonite
224	3-ft chip, fault, N. 20° W.	.7	ND	---	---	X	ND	ND	ND		Do.
225	3-ft chip, heavy iron stain.	.8	.008	---	---	X	ND	ND	ND		Do.

Table 4.--Data for samples on Richmond Mountain area map, excluding samples on Richmond adit, Big vein adits, and Pilgrim No. 1 adit maps and table 5--Continued

Sample		Analytical Results									Remarks
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	
No.	Description	oz/ton		percent		detected spectrographically					
		Cascade Mtn--Continued									
226	2-ft chip, 16-in. quartz vein, N. 25° E., dip vertical, in decline.	9.8	0.042	ND	0.22	X	ND	X	X		Kmv hornfels.
249	Dump, caved prospect	ND	ND	---	---	X	ND	ND	ND		Kmv sandstone.
250	2-ft chip, vein, N. 35° E., dip 75° NW.	ND	ND	---	---	X	ND	ND	ND		Kmv hornfels.
258	Dump, pit	ND	ND	---	---	ND	ND	ND	ND		Do.
259	Do.	ND	ND	---	---	X	ND	X	ND	Ni	Kmv sandstone.
260	Do.	ND	ND	---	---	X	ND	X	ND	Ni	Do.
261	Dump, pit	ND	.102	---	---	X	ND	X	ND	Ni	Kmv hornfels.
262	Do.	ND	ND	---	---	X	ND	X	ND		Do.
263	Do.	ND	ND	---	---	X	X	ND	ND	Ni	Kmv sandstone.
264	Do.	.2	ND	---	---	X	ND	X	X		Do.
265	2-ft chip, calcite vein, N. 35° W.	.3	ND	0.06	---	X	ND	X	ND		Do.
266	Dump, pit	ND	ND	---	---	X	ND	X	X	Cr, Ni	Do.
267	Do.	ND	ND	---	---	X	ND	ND	ND		Do.
268	Do.	.8	ND	1.74	---	X	ND	X	X	Cd	Do.

Table 4.--Data for samples on Richmond Mountain area map, excluding samples on Richmond adit, Big vein adits, and Pilgrim No. 1 adit maps and table 5--Continued

Sample No.	Description	Analytical Results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
					Cascade Mtn--Continued						
269	Dump, pit	ND	ND	---	---	X	ND	X	ND		Kmv sandstone.
270	Do.	ND	ND	---	---	X	ND	ND	ND		Do.
271	Do.	0.4	ND	---	---	X	ND	ND	ND	Cr, Ni	Do.
272	Do.	ND	ND	---	---	X	ND	ND	ND		Kmv shale.
273	Do.	ND	ND	---	---	X	ND	ND	ND		Kmv sandstone.

Table 5.--Data for samples on Big vein adits map

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
	Upper adit										
233	3 1/2-ft chip, 3-in. vein.	4.1	ND	2.49	5.10	X	ND	X	X	Co	
234	3-ft chip, 3-ft vein	7.7	0.046	3.00	4.60	X	ND	X	X	Co	
235	3-ft chip, 2-in. vein	.3	ND	.34	.40	X	ND	X	X		
	Lower adit										
236	1-ft chip, 1-ft vein	2.0	ND	1.39	.04	X	X	X	X	Cr	
237	9-in. chip, 9-in. vein	3.2	ND	.94	.60	X	ND	X	X		
238	4-ft chip, 1-ft vein	21.2	.02	---	---	X	X	X	X		
239	2 1/2-ft chip, 2-in. vein.	.6	ND	.18	.26	X	ND	X	ND		
240	2-ft chip, 2-ft vein	1.7	ND	.43	1.10	X	ND	X	X		
241	3-ft chip, 1 1/2-ft vein.	6.7	.01	ND	ND	X	X	X	X		
242	6-in. chip, back fall from 3-ft vein.	6.0	ND	1.73	4.20	X	X	X	X	Cd	
243	1-ft chip, 1-ft vein	2.4	ND	1.63	3.80	X	X	X	X		

Table 6.--Data for samples from on the Big vein, but not from the adits

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
227	2-ft chip, 4-in. vein	0.8	ND	---	0.36	X	ND	X	ND		Kmv hornfels.
228	2-ft chip, calcite vein, N. 40° W.	ND	ND	---	---	X	ND	ND	ND		In qmp dike, both cut Big vein, Kmv hornfels.
229	4-ft chip, 1 1/2-ft vein	.4	ND	---	---	X	ND	X	ND		Kmv hornfels.
230	4-ft chip, 2 1/2-ft vein	1.9	ND	---	---	X	ND	X	ND		Do.
231	Stockpile from above	2.1	0.030	1.33	1.60	X	ND	X	X		
232	3-ft chip, 1 1/2-ft vein	.3	.052	---	---	X	ND	X	ND		Kmv hornfels.
244	2-ft chip, 2-ft vein	1.4	.078	.46	.28	X	ND	X	ND		Kmv sandstone.
245	Dump, caved pit	3.4	.040	4.89	2.30	X	ND	X	X		Do.
246	Do.	.3	ND	.51	.35	X	ND	X	X		Do.

Table 5.--Data for samples from the Big vein, but not from the adits

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Fe (detected spectrographically)	Co (detected spectrographically)	Other (detected spectrographically)	Remarks
227	2-ft chip, 1-in. vein	0.8	ND	---	0.50	X	ND	X	ND		Kay Norelels.
228	2-ft chip, calcite vein, N. 40° W.	ND	ND	---	---	X	ND	ND	ND		In gap dike. Both out Big vein. Kay Norelels.
229	4-ft chip, 1 1/2-ft vein	.4	ND	---	---	X	ND	X	ND		Kay Norelels.
230	4-ft chip, 1 1/2-ft vein	1.0	ND	---	---	X	ND	X	ND		Do.
231	Sample from dump	7.1	0.040	1.20	1.20	X	ND	X	X		
232	3-ft chip, 1 1/2-ft vein	.4	.002	---	---	X	ND	X	ND		Kay Norelels.
244	2-ft chip, 2-ft vein	1.4	.010	.04	.12	X	ND	X	ND		Kay sandstone.
245	Dump, caved pit	3.4	.040	4.80	2.10	X	ND	X	X		Do.
246	Do.	.3	ND	.01	.15	X	ND	X	X		Do.

Table 7.--Data for samples on Richmond adit map

Sample		Analytical results									Remarks
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	
No.	Description	oz/ton		percent		detected spectrographically					
195	2-ft chip, collar of raise, vein	4.5	0.01	---	---	X	X	X	X		Kmv hornfels.
196	1-ft chip, fault	.5	ND	---	---	X	ND	ND	ND		
197	2-ft chip, fault	ND	ND	---	---	X	ND	ND	ND		
198	Do.	ND	ND	---	---	X	ND	ND	ND		
199	2 1/2-ft chip, fault	ND	ND	---	---	X	ND	ND	ND		
200	2-ft chip, fault	.3	ND	---	---	X	ND	ND	ND	Ni	
201	1-ft chip, fault	ND	ND	---	---	X	ND	ND	ND		
202	Do.	.4	ND	---	---	X	ND	ND	ND		
203	2 1/2-ft chip, 2-ft vein	.4	ND	0.93	0.70	X	ND	X	X	As	
204	15-in. chip, 4-in. vein	1.1	.048	.21	---	X	ND	X	X		
205	2 1/2-ft chip, 6-in. vein	.5	ND	---	---	X	ND	X	ND	As	
206	2 1/2-ft chip, 1-ft vein	1.1	.046	---	---	X	ND	X	ND		
207	2 1/2-ft chip, fault	ND	ND	---	---	X	X	X	ND	Cr	
208	1-ft chip, fault	.7	.034	---	---	X	ND	ND	ND		
209	9-in. chip, fault	ND	ND	---	---	X	ND	ND	ND		
210	22-in. chip, fault	ND	ND	---	---	X	ND	ND	ND		

Table 3.--Data for samples on disposal site boreholes

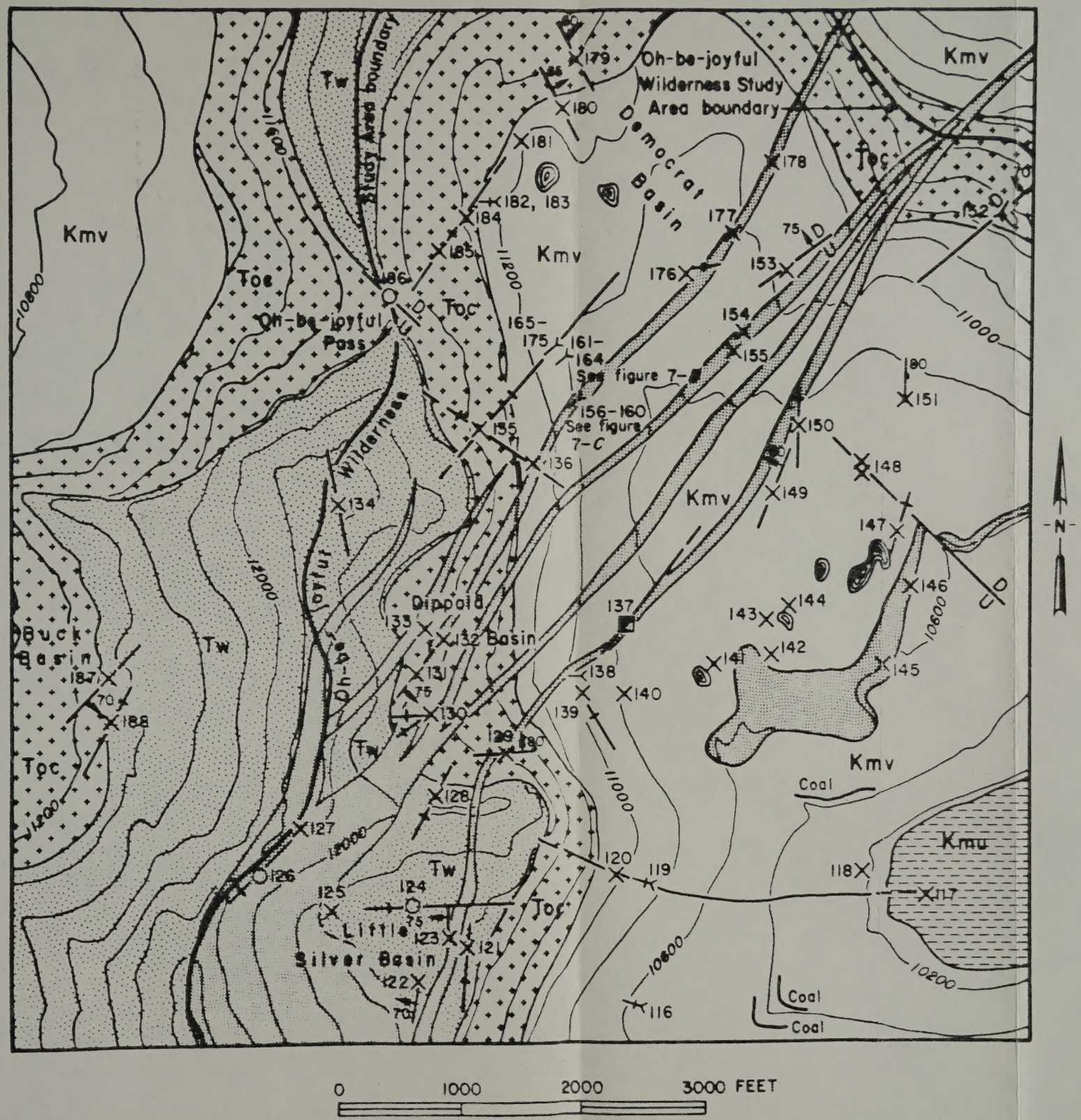


Figure 7A.--Simplified geologic map of Democrat Basin area (adapted from Gaskill and others, 1967) showing sample localities 117-188.

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)
161	1 1/2-ft chip, 4-in. fault.	ND	ND	0.12	0.04	X	ND	X	ND	Ni
162	20-in. chip.	ND	ND	ND	.01	X	ND	ND	ND	
163	2-ft chip, fault.	0.7	ND	.03	.01	X	ND	X	ND	Ni
164	2-ft chip.	.5	ND	.04	.04	X	ND	X	ND	
165	2 1/2-ft chip, fault.	ND	ND	.24	.02	X	ND	X	ND	
166	2 1/2-ft chip, 6-in. gouge.	ND	ND	.07	.01	X	ND	X	ND	
167	2-ft chip, 4-in. gouge.	.4	ND	.63	.12	X	ND	X	ND	
168	2 1/2-ft chip, 10-in. gouge.	ND	ND	.04	.32	X	ND	X	ND	
169	3-ft chip, fault.	ND	ND	.03	.02	X	ND	X	ND	
170	2-ft chip, fault.	.7	ND	.77	2.20	X	ND	X	X	
171	2 1/2-ft chip, fault.	ND	ND	.03	.01	ND	ND	ND	ND	
172	2 1/2-ft chip, fault.	.7	ND	.03	.32	X	ND	ND	ND	
173	1 1/2-ft chip, 14-in. gouge.	1.7	0.026	3.53	1.40	X	ND	X	X	
174	1 1/2-ft chip, fault.	.6	ND	1.52	2.20	X	ND	X	X	
175	Stockpile.	5.6	ND	10.50	7.00	X	ND	X	X	Cd

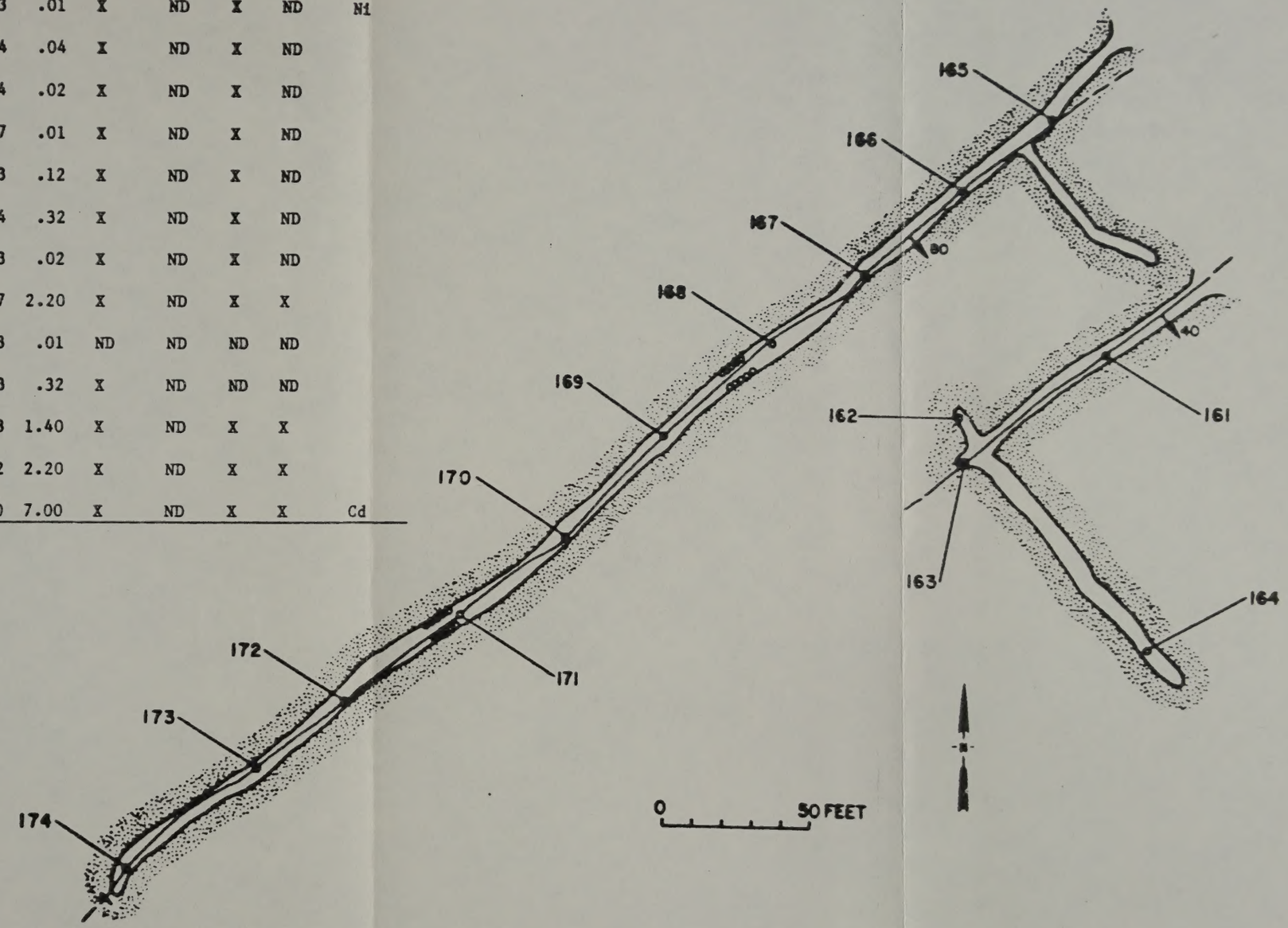
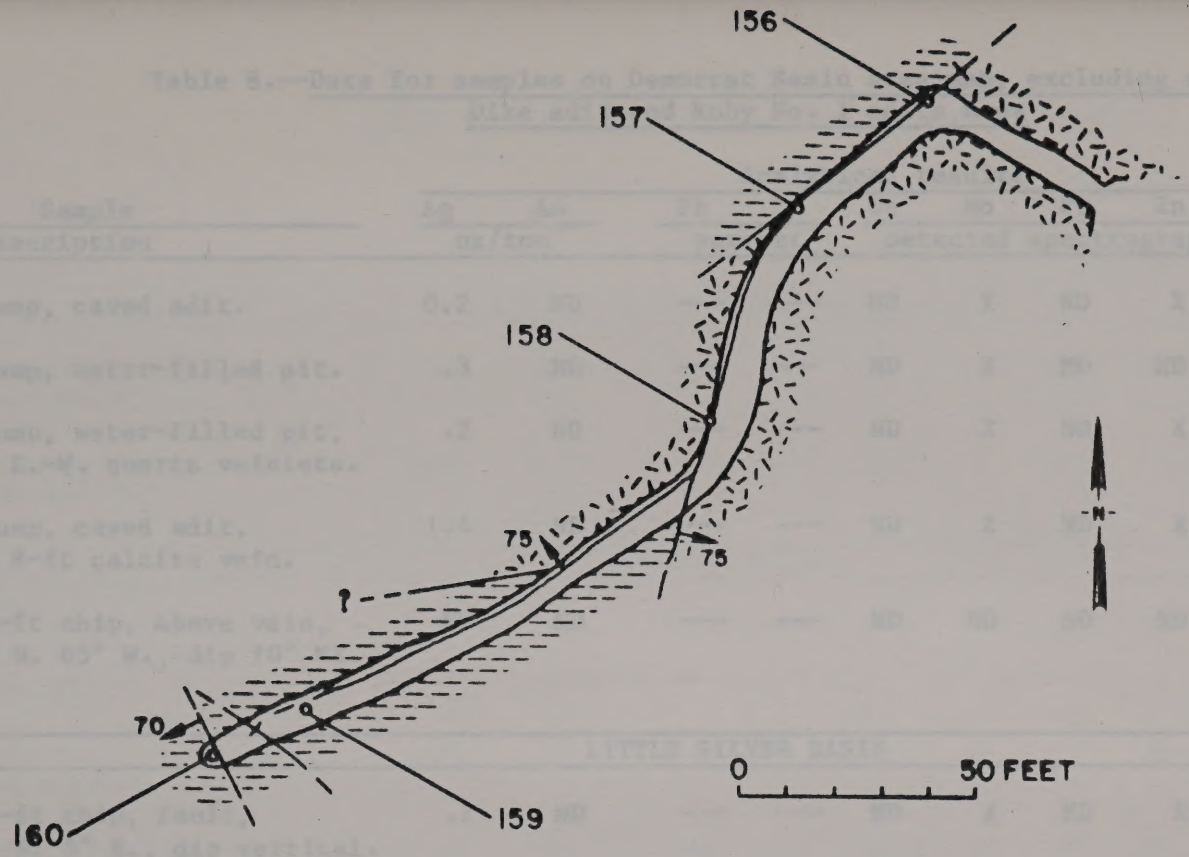


Figure 7B.--Ruby No. 1 adit map showing sample localities 161-175, and table showing analytical data for samples.



Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)
156	28-in. chip, 2-in. vein.	0.5	ND	---	---	X	ND	X	ND	
157	20-in. chip, 3-in. vein	ND	ND	---	---	X	ND	X	ND	Cr, Ni
158	28-in. chip, fault.	.2	ND	---	---	X	ND	X	ND	
159	1 1/2-ft chip, no structure.	.3	ND	---	---	X	ND	X	ND	
160	20-in. chip, fault.	ND	ND	---	---	ND	ND	ND	ND	

Figure 7-C.--Dike adit, showing sample localities 156-160, and table showing analytical data for samples.

Table 8.--Data for samples on Democrat Basin area map, excluding samples on Dike adit and Ruby No. 1 adits maps

Sample		Analytical results									Remarks
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	
No.	Description	oz/ton		percent		detected spectrographically					
116	Dump, caved adit.	0.2	ND	---	---	ND	X	ND	X		Kmv sandstone.
117	Dump, water-filled pit.	.3	ND	---	---	ND	X	ND	ND		Do.
118	Dump, water-filled pit, E.-W. quartz veinlets.	.2	ND	---	---	ND	X	ND	X	Cr	Do.
119	Dump, caved adit, 8-ft calcite vein.	1.4	ND	---	---	ND	X	ND	X		qmp dike.
120	8-ft chip, above vein, N. 65° W., dip 70° NE.	ND	ND	---	---	ND	ND	ND	ND		qmp foot wall Toc hanging wall.
	LITTLE SILVER BASIN										
121	1-ft chip, fault, N. 5° E., dip vertical.	.2	ND	---	---	ND	X	ND	X		Tw
122	3-ft chip, fault, N. 10° E., dip 70° NW.	.6	0.068	---	---	ND	X	ND	X		Do.
123	3-ft chip, fault, N.-S., dip 75° W.	.4	.008	---	---	ND	X	ND	X		Do.
124	1-ft chip, breccia zone, E.-W.	ND	ND	---	---	ND	X	ND	ND		Do.
125	Dump, caved pit.	.2	ND	---	---	ND	ND	ND	ND		Do.

Table 8.--Data for samples on Democrat Basin area map, excluding samples on Dike adit and Ruby No. 1 adit maps

Sample No:	Description	Analytical results: Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	Remarks
		oz/ton		percent		detected spectrographically					
118	Dump, caved adit.	0.2	ND	---	---	ND	X	ND	X		Tan sandstone.
117	Dump, water-filled pit.	.3	ND	---	---	ND	X	ND	ND		Do.
116	Dump, water-filled pit, S.-W. quartz veinlets.	.2	ND	---	---	ND	X	ND	X	Cr	Do.
119	Dump, caved adit, S-ft calcite vein.	1.4	ND	---	---	ND	X	ND	X		Gray dike.
120	6-ft chip, shear vein, N. 85° W., dip 70° NE.	.2	ND	---	---	ND	ND	ND	ND		Deep foot wall for hanging wall.
121	1-ft chip, fault, N. 3° E., dip vertical.	.2	ND	---	---	ND	X	ND	X		Tw
122	3-ft chip, fault, N. 10° E., dip 70° NW.	.8	0.056	---	---	ND	X	ND	X		Do.
123	3-ft chip, fault, N.-S., dip 75° W.	.4	.008	---	---	ND	X	ND	X		Do.
124	1-ft chip, breccia zone, S.-W.	ND	ND	---	---	ND	X	ND	ND		Do.
125	Dump, caved pit.	.2	ND	---	---	ND	ND	ND	ND		Do.

Table 8.--Data for samples on Democrat Basin area map, excluding samples on Dike adit and Ruby No. 1 adits maps--Continued

Sample		Analytical results									Remarks
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	
No.	Description	oz/ton		percent		detected spectrographically					
					LITTLE SILVER BASIN--Continued						
126	2-ft chip, fault, N. 45° E.	ND	ND	---	---	ND	X	ND	ND		qmp
127	1-1/2-ft chip, fault, N. 15° E.	0.6	0.02	---	---	ND	X	ND	X		Do.
					DIPPOLD BASIN						
128	2-ft chip, fault, N. 30° E., dip vertical.	ND	ND	---	---	ND	X	ND	ND		Do.
129	4-ft chip, fault, E-W., dip 80° N.	ND	ND	---	---	ND	X	X	ND	Cr	Tw
130	2-ft chip, faults, N. 60° E. and E-W.	ND	ND	---	---	ND	X	ND	ND		Do.
131	Dump, water-filled pit, fault, N. 40° E., dip 75° SE.	ND	ND	---	---	ND	X	X	X	Cr	Do.
132	3-ft chip, pit on above fault.	ND	ND	---	---	ND	X	ND	X	Cr	qmp
133	2-ft chip, fault, N. 40° E.	ND	ND	---	---	ND	X	ND	ND	Cr	Do.
					DEMOCRAT BASIN						
134	Dump, caved pit, N. 15° W., bleached zone.	.2	ND	---	---	ND	X	ND	X		Tw

Table 8.--Data for samples on Democrat Basin area map excluding samples Dike adit and Ruby No. 1 adits maps--Continued

Sample		Analytical results									Remarks
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	
No.	Description	oz/ton		percent		detected spectrographically					
		DEMOCRAT BASIN--Continued									
135	5-ft chip, calcite vein, N. 60° W., dip vertical.	0.3	ND	---	---	ND	X	ND	ND		Kmv sandstone
136	3 1/2-ft chip, same vein.	ND	ND	---	---	ND	X	ND	X		Kmv shale
137	Dump, caved shaft, fault, N. 40° E.	2.4	ND	0.61	---	ND	X	ND	X	Cr	qmp dike
138	4-ft chip, barren adit.	ND	ND	---	---	ND	X	ND	ND		Kmv shale
139	15-in. chip, calcite vein, N. 35° W.	2.3	0.020	---	---	ND	X	ND	X	As	Kmv sandstone
140	Dump, 60° decline.	ND	ND	---	---	ND	X	ND	X		Kmv sandstone
141	Dump, caved pit.	ND	ND	---	---	ND	X	ND	ND		Do.
142	Dump, water-filled pit.	.6	ND	---	---	ND	ND	ND	ND	Cr, Ni	Do.
143	2-ft chip, pit with plentiful pyrite.	ND	ND	---	---	ND	X	ND	ND		Do.
144	Do.	ND	ND	---	---	ND	X	ND	ND		Do.
145	Dump, water-filled pit.	ND	ND	---	---	ND	X	ND	ND	Cr, Ni	qmp sill
146	Dump, caved pit.	.2	ND	---	---	ND	ND	ND	ND		Do.

Table 8.--Data for samples on Democrat Basin area map excluding samples
Dike suit and Rocky No. 1 suite maps--Continued

Sample No.	Description	Analytical results: Ag (oz/ton)	As (percent)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Sn (detected spectrographically)	Others (detected spectrographically)	Remarks
	DEMOCRAT BASIN--Continued										
133	5-ft chip, calcite vein, N. 80° W., dip vertical.	0.3	ND	---	---	ND	X	ND	ND		Key sandstone
134	3 1/2-ft chip, same vein.	ND	ND	---	---	ND	X	ND	X		Key shale
135	Dump, caved shaft, fault, N. 60° E.	2.4	ND	0.01	---	ND	X	ND	X	Cr	Key dike
136	5-ft chip, barren adit.	ND	ND	---	---	ND	X	ND	ND		Key shale
137	15-in. chip, calcite vein, N. 15° W.	1.3	0.010	---	---	ND	X	ND	X	As	Key sandstone
140	Dump, 60° decline.	ND	ND	---	---	ND	X	ND	X		Key sandstone
141	Dump, caved pit.	ND	ND	---	---	ND	X	ND	ND		Do.
142	Dump, water-filled pit.	.6	ND	---	---	ND	ND	ND	ND	Cr, Ni	Do.
143	2-ft chip, ore with pisolitic pyrite.	ND	ND	---	---	ND	X	ND	ND		Do.
144	Do.	ND	ND	---	---	ND	X	ND	ND		Do.
145	Dump, water-filled pit.	ND	ND	---	---	ND	X	ND	ND	Cr, Ni	Key silt
146	Dump, caved pit.	.2	ND	---	---	ND	ND	ND	ND		Do.

Table 8.--Data for samples on Democrat Basin area map excluding samples Dike adit and Ruby No. 1 adits maps--Continued

Sample		Analytical results									Remarks
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	
No.	Description	oz/ton		percent		detected spectrographically					
		DEMOCRAT BASIN--Continued									
147	Dump, caved pit, fault, N. 15° E.	0.5	ND	---	---	X	ND	X	X	Cr, Ni	Kmv sandstone
148	Dump, caved pit.	.2	ND	---	---	ND	X	ND	X		Kmv sandstone and shale
149	Dump, water-filled pit, fault, N. 25° E., dip 80° NW.	.2	0.01	---	---	ND	ND	X	X		Kmv sandstone
150	1 1/2-ft chip, fault, N.-S., dip vertical.	3.1	ND	---	---	X	ND	ND	ND		Kmv sandstone
151	Dump, pit, joints, N.-S., dip 80° E.	.4	0.02	---	---	ND	X	X	X		Do.
152	4-ft chip, portal of water-filled adit.	.6	.032	---	---	X	ND	X	ND		qmp sill footwall, Kmv sandstone, hanging wall.
153	2 1/2-ft chip, fault, N. 55° E., dip 75° NW.	ND	ND	---	---	ND	X	ND	X		Kmv sandstone
154	3-ft chip, fault, N. 35° E.	.1	.01	---	---	ND	X	X	X	W	qmp
155	3-ft chip, pit on dike contact.	ND	ND	---	---	X	ND	X	ND		qmp dike

Table 8.--Data for samples on Democrat Basin area map excluding samples Dike adit and Ruby No. 1 adits maps--Continued

Sample		Analytical results									Remarks
		Ag	Au	Pb	Zn	Cu	Mo	Pb	Zn	Other	
No.	Description	oz/ton		percent		detected spectrographically					
					DEMOCRAT BASIN--Continued						
176	Dump, shaft, joints, N. 80° E.	ND	ND	---	---	X	ND	X	ND		Kmv sandstone
177	Dump, caved pit.	0.2	0.05	---	---	X	X	X	X	W	qmp dike
178	Do.	.2	.01	---	---	ND	X	ND	X		Do.
179	3-ft chip, fault, N. 30° W., dip 60° NE.	.1	ND	---	---	ND	ND	X	X		Kmv sandstone
180	2 1/2-ft chip, fault, N. 30° W., dip 65° NE.	.2	ND	---	---	X	ND	ND	ND		Do.
181	3-ft chip, no structure.	ND	ND	---	---	X	ND	X	ND		Do.
182	Dump, caved adit.	ND	ND	0.06	0.18	X	ND	X	ND		Do.
183	Stockpile, above adit.	2.5	ND	.44	.17	X	X	X	ND		Do.
184	Dump, 12-ft pit, fault, N. 30° E.	.5	ND	.06	---	X	ND	X	ND		Toc sandstone
185	3 1/2-ft chip, fault, N. 30° E.	1.2	ND	---	---	X	ND	X	ND		Do.
186	2-ft chip, fault, N. 50° W.	ND	ND	---	---	X	ND	X	ND		Tw sandstone
					BUCK BASIN						
187	4-ft chip, fault, N. 45° E., dip 70° SE.	.1	ND	---	---	ND	ND	X	X		Do.
188	2-ft chip, fault, N. 30° E., dip vertical.	.2	ND	---	---	ND	ND	X	X		Do.

Table 6.--Data for samples on Homestead Basalt area and overlying deposits

Pike adit and Ruby No. 1 adits maps--Continued

Sample No.	Description	Analytical results: Sq detected	As detected	Ba detected	Cr detected	Mo detected	Pb detected	Sn detected	Other detected spectrographically	Remarks
	HOMESTEAD BASALT--Continued									
175	Dump, shaft, joints, N. 80° E.	ND	ND	---	---	X	ND	X	ND	Ksv sandstone
177	Dump, caved pit.	0.2	0.05	---	---	X	X	X	X M	cop dike
178	Do.	.2	.01	---	---	ND	X	ND	X	Do.
179	3-ft chip, fault, N. 30° W., dip 60° NE.	.1	ND	---	---	ND	ND	X	X	Ksv sandstone
180	2 1/2-ft chip, fault, N. 30° W., dip 85° NE.	.2	ND	---	---	X	ND	ND	ND	Do.
181	3-ft chip, no structure.	ND	ND	---	---	X	ND	X	ND	Do.
182	Dump, caved adit.	ND	ND	0.06	0.18	X	ND	X	ND	Do.
183	Brockpile, above adit.	2.5	ND	.44	.17	X	X	X	ND	Do.
184	Dump, 12-ft pit, fault, N. 10° E.	.5	ND	.06	---	X	ND	X	ND	Tpc sandstone
185	3 1/2-ft chip, fault, N. 30° E.	1.2	ND	---	---	X	ND	X	ND	Do.
186	2-ft chip, fault, N. 30° W.	ND	ND	---	---	X	ND	X	ND	Tv sandstone
	IRON BASIN									
187	4-ft chip, fault, N. 45° E., dip 70° SE.	.1	ND	---	---	ND	ND	X	X	Do.
188	2-ft chip, fault, N. 30° E., dip vertical.	.2	ND	---	---	ND	ND	X	X	Do.

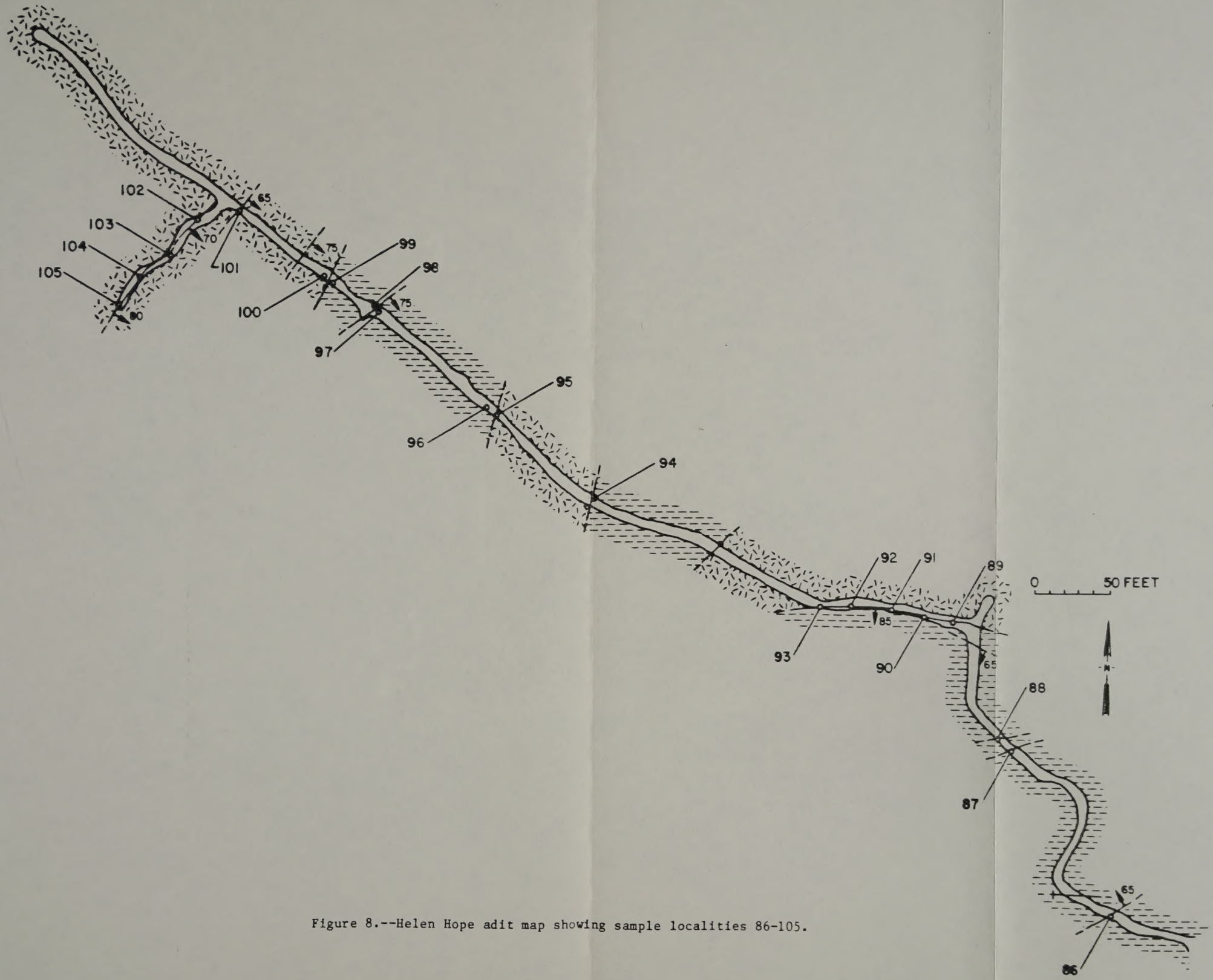


Figure 8.--Helen Hope adit map showing sample localities 86-105.

Table 9.--Data for samples on Helen Hope adit map

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Remarks
86	3-in. chip, calcite vein.	ND	ND	---	---	ND	X	ND	ND	
87	Do.	0.1	ND	---	---	ND	X	ND	ND	
88	3-in. chip, quartz-calcite vein.	ND	ND	---	---	ND	X	ND	X	
89	22-in. chip, fault.	.1	ND	---	---	ND	X	ND	X	
90	17-in. chip, fault.	ND	ND	---	---	ND	X	ND	X	porphyry
91	15-in. chip, fault.	ND	ND	---	---	ND	X	ND	X	Do.
92	21-in. chip, fault.	ND	ND	---	---	ND	X	ND	X	Do.
93	1-ft chip, fault.	ND	ND	---	---	ND	X	ND	X	Do.
94	2-ft chip, shale side of contact.	.1	ND	---	---	ND	X	ND	X	
95	1-ft chip, porphyry side of contact.	ND	ND	---	---	ND	X	ND	X	
96	2 1/2-ft chip, shale side of contact.	ND	ND	---	---	ND	ND	X	X	
97	3-in. chip, calcite-pyrite vein.	.1	ND	---	---	ND	X	ND	X	
98	3 1/2-ft chip, excluding vein.	ND	ND	---	---	ND	X	ND	X	Same place as no. 97.

Table 9.--Data for samples on Helen Hope adit map

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Remarks
86	3-in. chip, calcite vein.	ND	ND	---	---	ND	X	ND	ND	
87	Do.	0.1	ND	---	---	ND	X	ND	ND	
88	3-in. chip, quartz-calcite vein.	ND	ND	---	---	ND	X	ND	X	
89	22-in. chip, fault.	.1	ND	---	---	ND	X	ND	X	
90	17-in. chip, fault.	ND	ND	---	---	ND	X	ND	X	porphyry
91	15-in. chip, fault.	ND	ND	---	---	ND	X	ND	X	Do.
92	21-in. chip, fault.	ND	ND	---	---	ND	X	ND	X	Do.
93	1-ft chip, fault.	ND	ND	---	---	ND	X	ND	X	Do.
94	2-ft chip, shale side of contact.	.1	ND	---	---	ND	X	ND	X	
95	1-ft chip, porphyry side of contact.	ND	ND	---	---	ND	X	ND	X	
96	2 1/2-ft chip, shale side of contact.	ND	ND	---	---	ND	ND	X	X	
97	3-in. chip, calcite-pyrite vein.	.1	ND	---	---	ND	X	ND	X	
98	3 1/2-ft chip, excluding vein.	ND	ND	---	---	ND	X	ND	X	Same place as no. 97.

Table 9.--Data for samples on Helen Hope adit map--Continued

Sample No.	Description	Analytical results: Ag oz/ton	Au oz/ton	Pb percent	Zn percent	Cu detected spectrographically	Mo detected spectrographically	Pb detected spectrographically	Zn detected spectrographically	Remarks
99	2-ft chip, shale side of contact.	ND	ND	---	---	ND	X	ND	X	
100	15-in. chip, porphyry side of contact.	ND	ND	---	---	ND	ND	ND	X	
101	5 1/2-ft chip, quartz vein with sphalerite.	0.1	ND	---	1.60	ND	ND	X	ND	
102	14-in. chip.	ND	ND	---	.53	ND	X	X	ND	
103	19-in. chip on footwall.	ND	ND	---	.21	ND	X	X	ND	
104	10-in. chip, fault.	ND	ND	---	---	ND	X	X	ND	
105	3-in. chip, quartz-pyrite vein.	ND	ND	---	---	ND	X	ND	X	

Table 9.--Data for samples on Helen Rose adit map--Continued

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Sn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Remarks
99	2-ft chip, shale side of contact.	ND	ND	---	---	ND	X	ND	X	
100	15-in. chip, porphyry side of contact.	ND	ND	---	---	ND	ND	ND	X	
101	3 1/2-ft chip, quartz vein with sphalerite.	0.1	ND	---	1.60	ND	ND	X	ND	
102	14-in. chip.	ND	ND	---	.33	ND	X	X	ND	
103	19-in. chip on footwall.	ND	ND	---	.11	ND	X	X	ND	
104	10-in. chip, fault.	ND	ND	---	---	ND	X	X	ND	
105	3-in. chip, quartz-pyrite vein.	ND	ND	---	---	ND	X	ND	X	

Table 10.--Data for samples which are only on Plate 1

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
	LOWER JUSTICE BASIN										
34	Dump, 2 pits on fault, N. 60° E., dip 70° SE.	ND	ND	---	---	ND	X	X	X		Toc sandstone
35	Stockpile from above pits.	0.8	0.05	3.6	7.5	X	X	ND	ND		
36	Dump, shaft on N. 20° W. fault.	ND	ND	---	---	ND	ND	ND	ND		Toc sandstone
37	2-ft chip, fault, N. 50° E., dip 50° NW.	ND	ND	---	---	ND	X	X	X		Do.
	UPPER ROBINSON BASIN										
77	Dump, water-filled adit about 300 ft long on fault, N. 10° W., dip 75° NE.	.1	ND	---	---	ND	X	X	X		qmp
78	3 1/2-ft chip, fault, N. 55° W., dip 75° NE.	.2	ND	---	---	ND	X	ND	X		Tw sandstone
79	Dump, 40-ft pit, joints.	.1	ND	---	---	ND	X	X	X		Do.
80	Dump, water-filled pit, N. 60° E. quartz vein in joint.	.1	ND	---	---	ND	X	ND	ND		Do.
81	Dump, water-filled pit.	ND	ND	---	---	ND	ND	ND	ND		Do.
82	4 1/2-ft chip, fault, N. 15° W., dip 75° SW.	.1	ND	---	---	ND	X	X	ND		Tw sandstone
83	4-ft chip, faults, N. 40° E., dip 75° NW., and N. 40° E., dip 45° NW.	.1	.01	---	---	ND	ND	ND	X		Tw shale

Table 10.--Data for samples which are only on Plate 1--Continued

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
	UPPER ROBINSON BASIN--Continued										
84	1-ft chip, 1-ft vein, N. 30° W.	0.1	0.01	---	---	ND	X	ND	X		Tw shale
85	3-ft chip, fault, N. 85° E., dip 80° N.	.3	ND	---	---	ND	X	ND	X		qmp dike
106	3-ft chip, fault, N. 65° W.	.1	ND	---	---	X	X	X	X		Tw sandstone
107	3-ft chip, fault, N. 60° W., dip 80° NE.	ND	.01	---	---	X	X	X	X		qmp
108	2 1/2-ft chip, fault, N. 70° W., dip vertical.	ND	ND	---	---	ND	X	ND	X		Do.
109	Dump, 12-ft fault, N. 55° E.	1.1	.02	---	---	ND	X	X	X		Tw shale
	BLUE LAKE BASIN										
110	Specimen, caved pit.	.4	.02	---	---	X	X	X	ND		Tw sandstone
111	Dump, pit on N. 40° E. fault.	.2	.01	---	---	X	X	X	X		qmp
112	Dump, caved adit, N. 35° E. fault.	.8	.02	---	---	X	X	X	X		Tw conglomerate
113	Dump, caved pit, N. 40° W. quartz vein.	.1	ND	---	---	ND	X	ND	X		Toc sandstone
114	3-ft chip, N. 65° W. shear zone.	.2	ND	---	---	ND	ND	ND	X		qmp
115	Dump, caved adit, N. 50° E. fault.	.2	.01	---	---	ND	X	X	X	Co	Toc sandstone

Table 10.--Data for samples which are only on Plate 1--Continued

Sample No.	Description	Analytical results: Ag (oz/ton)	Au (oz/ton)	Pb (percent)	Zn (percent)	Cu (detected spectrographically)	Mo (detected spectrographically)	Pb (detected spectrographically)	Zn (detected spectrographically)	Other (detected spectrographically)	Remarks
	NORTH OF SCHUYLKILL MTN										
274	5-ft chip, fault, N. 75° E., dip 80° SE., portal of greater than 70-ft adit with bear tracks going in.	0.1	ND	---	---	ND	ND	X	X		Hanging wall qmp, foot wall Kmv sandstone.
275	4-ft chip, fault, N. 55° E., dip vertical.	.1	ND	---	---	X	X	X	X		SE. side qmp, NW. side Kmv sandstone.
	OH-BE-JOYFUL CREEK										
276	4-ft chip, sill.	ND	ND	---	---	ND	ND	ND	ND		Granite porphyry
277	1-ft chip, N. 35° E. quartz veinlets.	ND	ND	---	---	ND	ND	ND	ND		Kmu hornfels

EXPLANATION FOR FIGURES 4-8

APPROXIMATE BOUNDARY OF THE OH-BE-JOYFUL WILDERNESS STUDY AREA

APPROXIMATE BOUNDARY OF THE RAGGEDS WILDERNESS

41 LOCALITY OF SAMPLED OUTCROP--Showing sample number

80 FAULT OR VEIN--Showing dip and relative movement; dashed where uncertain

VERTICAL FAULT OR VEIN--Dashed where approximate

50 JOINT--Showing strike and dip

VERTICAL JOINT

CONTACT--Dashed where approximately located

Coal COAL BED

TRIANGULATION POINT

INTERMITTENT STREAM

12000 CONTOUR LINE--Showing elevation

SURFACE OPENINGS--Showing sample locality number

2 Adit

66 Caved adit

244 Shaft

181 Prospect pit or adit less than 50 feet long

Surface drill hole

MAP UNITS

Quartz monzonite porphyry

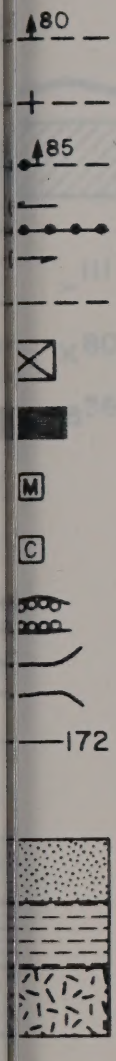
Tw Tertiary Wasatch Formation

Toc Tertiary Ohio Creek Formation (now upper member of Mesaverde Formation)

Kmv Cretaceous Mesaverde Formation

Kmu Cretaceous Mancos Shale

EXPLANATION FOR FIGURES 4-B, 4-C, 5-B, 6-B, C, D, 7-B, 7-C, and 8



FAULT--Showing dip; dashed where approximate

VERTICAL FAULT--Dashed where approximate

VEIN--Showing dip; dashed where approximate

VEIN--Showing relative vertical and horizontal movement

CONTACT--Dashed where approximate

RAISE

WINZE

MANWAY

CHUTE

TIMBERING

PORTAL

LOCALITY OF MINE MAP SAMPLE--Showing sample number

ROCK TYPES

Sandstone

Hornfels or shale

Quartz monzonite

EXPLANATION OF SYMBOLS FOR MINE AND PROSPECT MAP

APPROXIMATE BOUNDARY OF THE OH-BE-JOYFUL WILDERNESS STUDY AREA

PATENTED MINING CLAIMS

SURFACE OPENINGS--Showing sample locality number

111 Adit

80 Prospect pit or adit less than 50 feet long

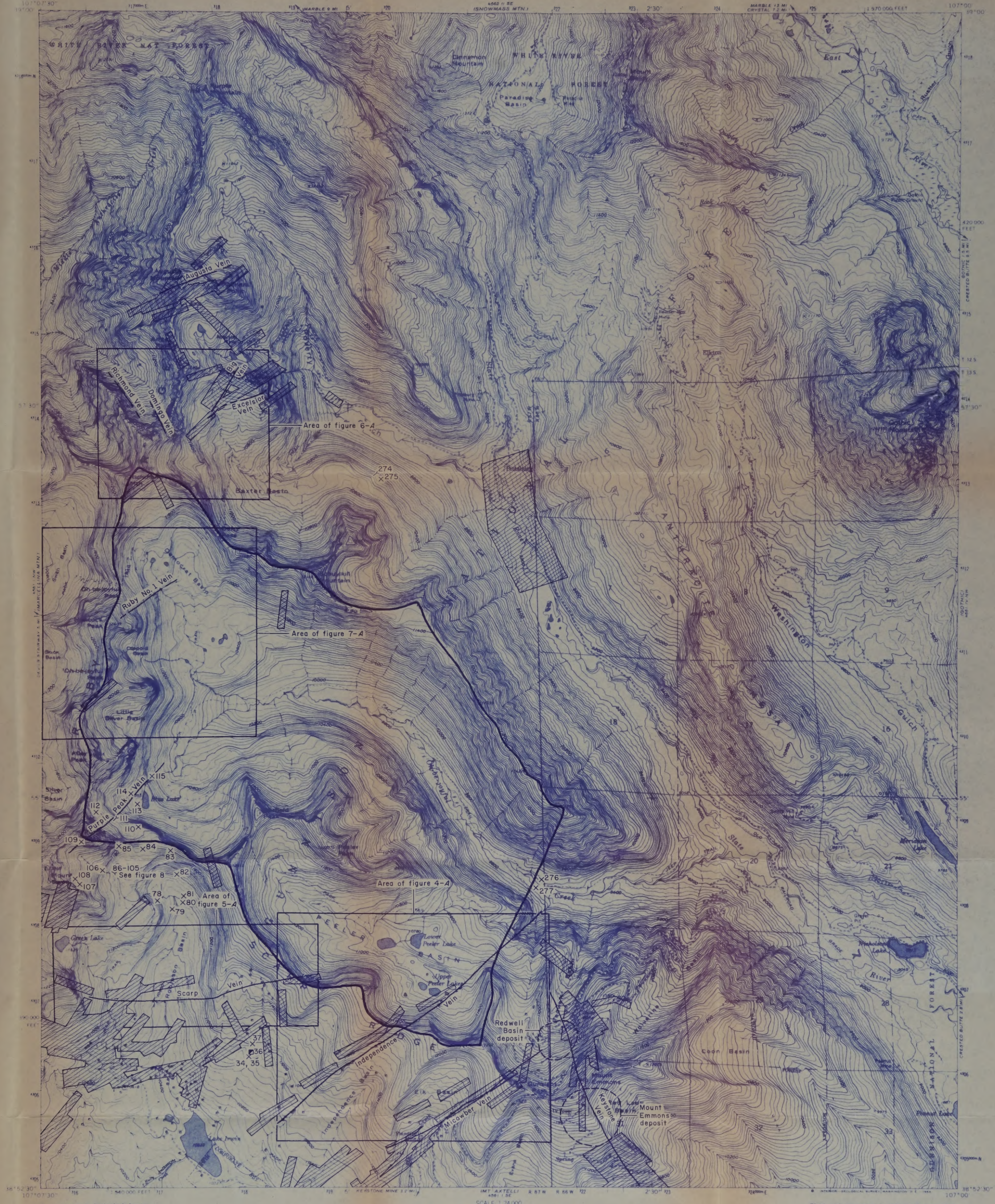
36 Shaft

#133045316 ID: 88070195 TN23 .M11 no. 83-81

1 map

DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

OPEN FILE REPORT
MLA 81-83
PLATE 1



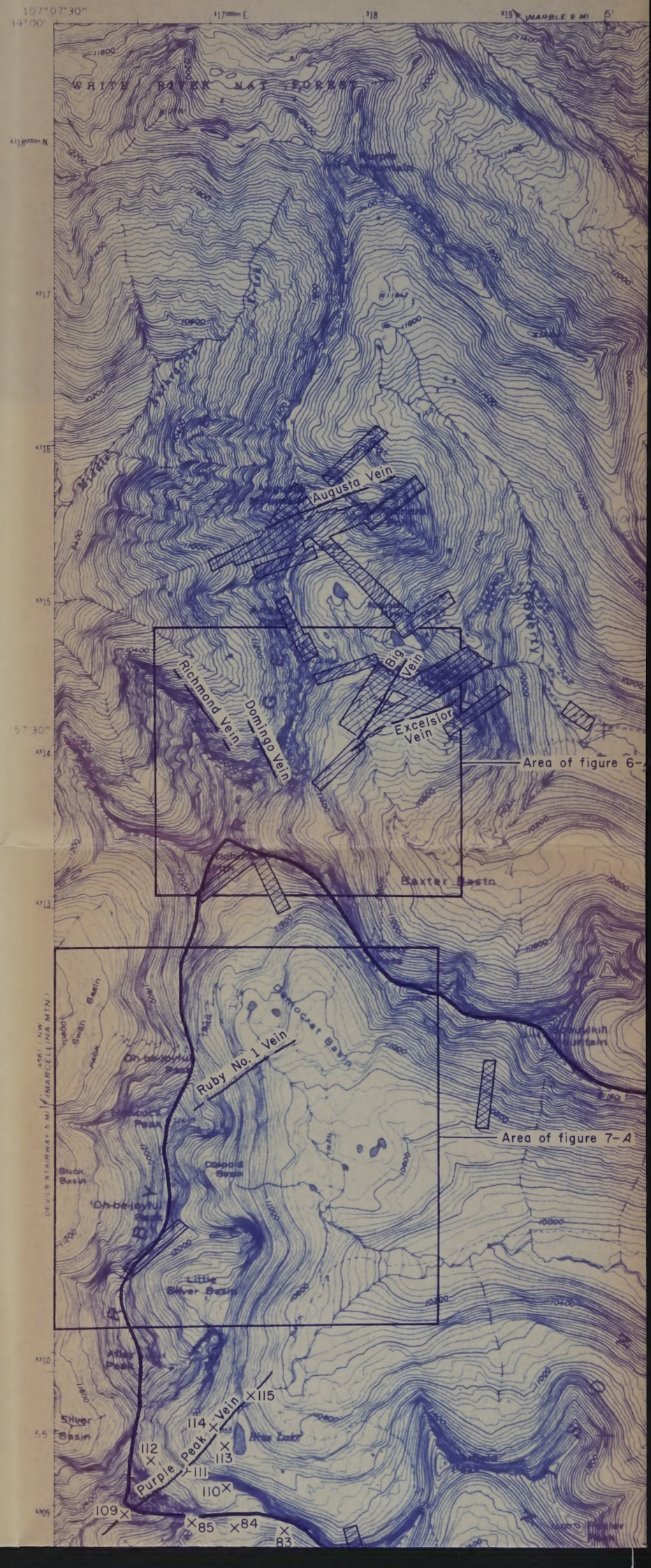
MINE AND PROSPECT MAP OF THE OH-BE-JOYFUL WILDERNESS STUDY AREA, GUNNISON COUNTY, COLORADO

BY

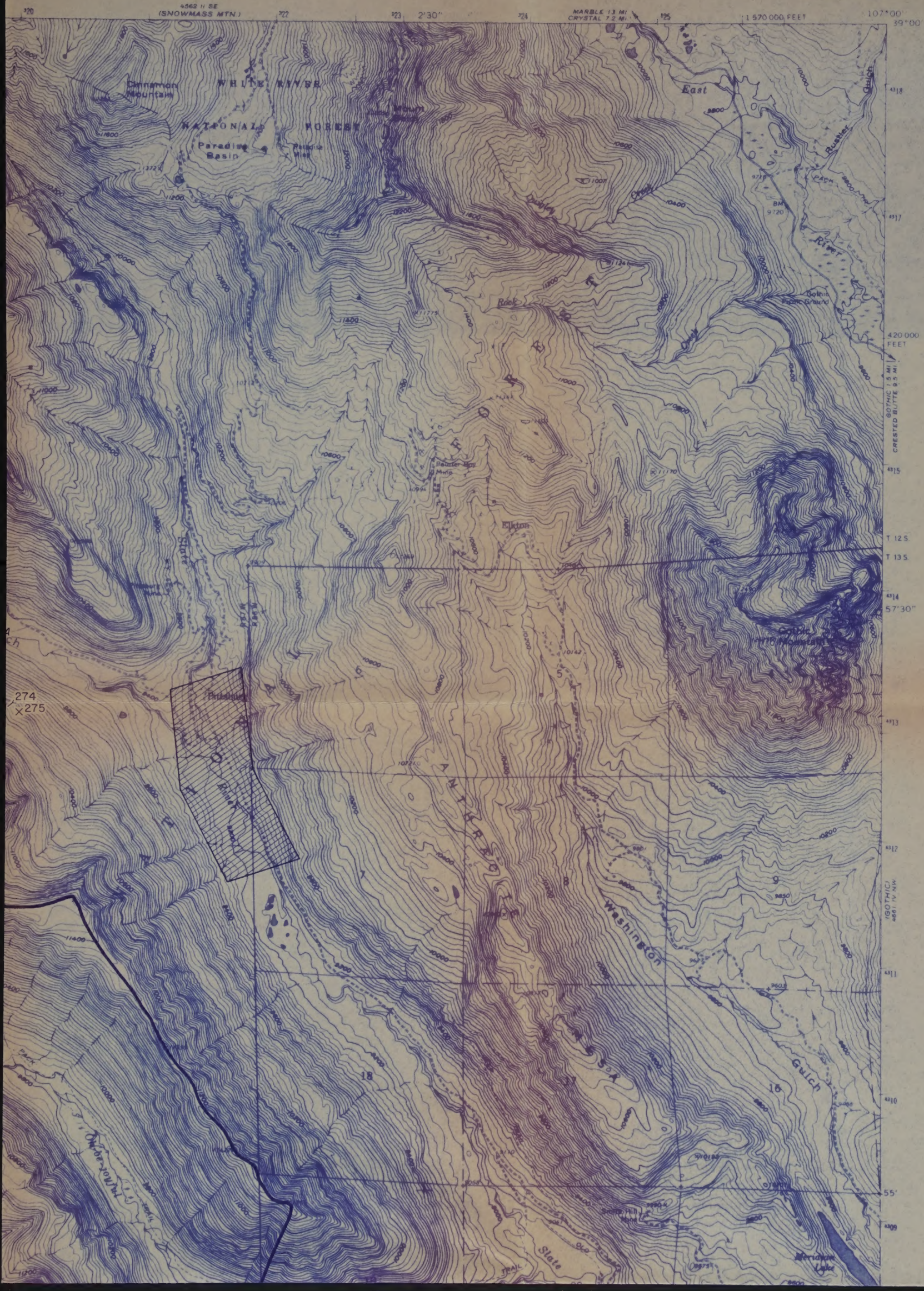
CLARENCE E. ELLIS, U.S. BUREAU OF MINES

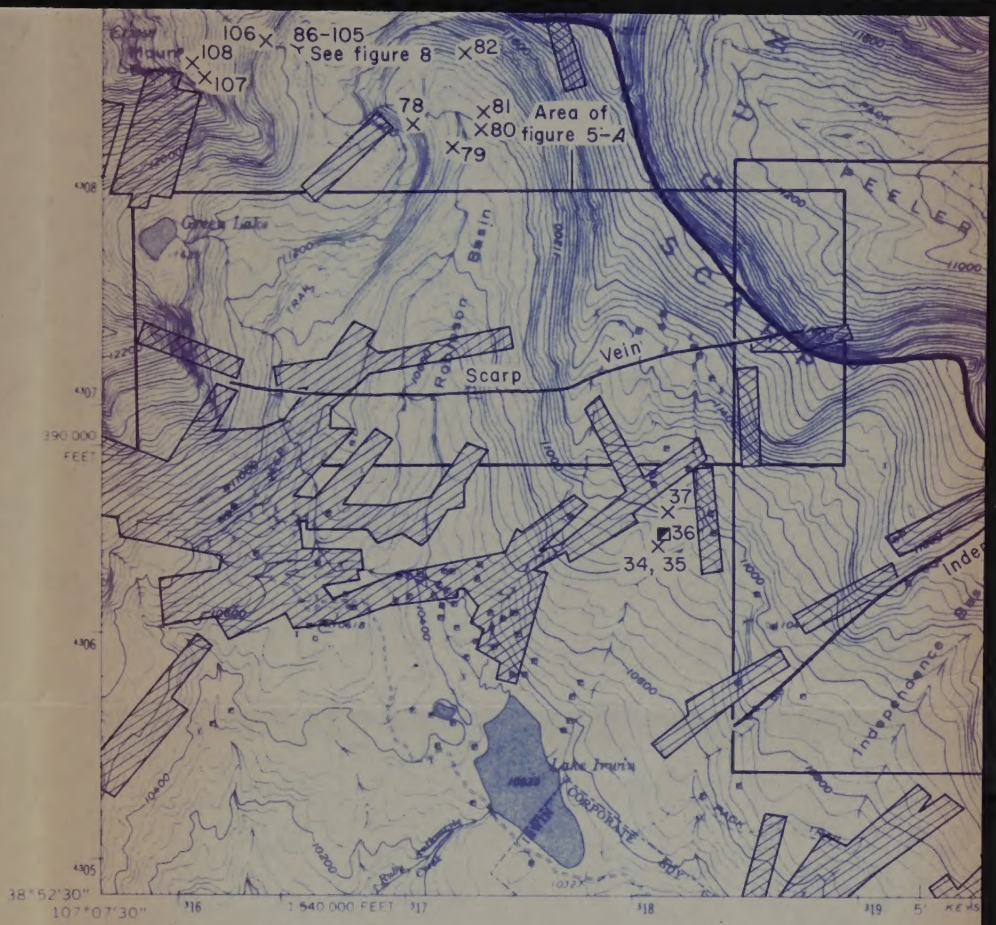
1983

DEPARTMENT OF THE INTERIOR
BUREAU OF MINES



OPEN FILE REPORT
MLA 81-83
PLATE 1





Base from U.S. Geological Survey
Oh-be-joyful, 1961.

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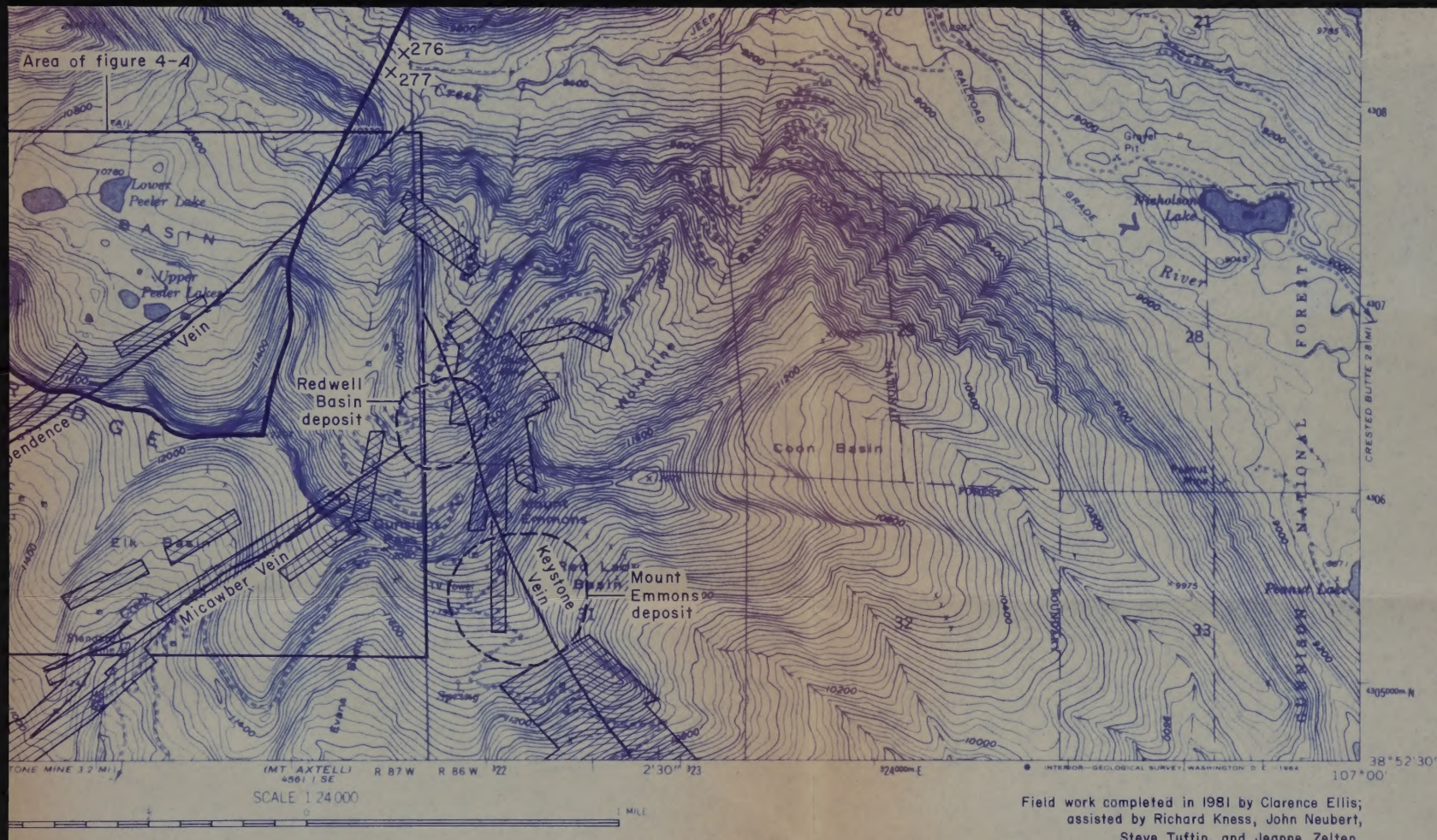

Field work completed in 1981 by Clarence Ellis; assisted by Richard Kness, John Neubert, Steve Tuftin, and Jeanne Zelten.

COLORADO

P OF THE OH-BE-JOYFUL WILDERNESS STUDY AREA, UNNISON COUNTY, COLORADO

BY

RENCE E. ELLIS, U.S. BUREAU OF MINES

1983